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Canotia is named for *Canotia holacantha* Torr. (Celastraceae), a spiny shrub or small tree nearly endemic to Arizona.

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A SURVEY OF THE VASCULAR PLANTS IN THE AREA OF LIME CREEK, MARICOPA COUNTY, ARIZONA: A UNIQUE UPLAND SONORAN DESERT ENVIRONMENT

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ABSTRACT

A survey of the vascular plants of the exposed late Tertiary limestone lacustrine unit and surrounding areas near Lime Creek in Tonto National Forest near Horseshoe Lake Recreation Area, Maricopa County, Arizona, was conducted from September 2003 to September 2006. The survey area comprises 1280 acres (two square miles) of Upland Sonoran Desert environment with washes and riparian habitats. We identified 254 native species and 17 introduced species from 199 genera and 68 families. This flora is unique in that it includes some species indicative of semidesert grasslands and interior chaparral that are presumed to be relicts of a Miocene pine-oak-juniper woodland (*Juniperus coahuilensis, Rhus ovata*); others that are endemics to this soil type (*Lotus mearnsii* var. *equisolensis, Purshia* ×*subintegra*); and finally species that are disjuncts from both higher elevations and other deserts (*Eriogonum ripleyi, Lesquerella cinerea, Packera neomexicana, Polygala rusbyi, Polygala macradenia, Polygala scoparioides, Thamnosma texanum*). Here we also report on two more disjunct species, *Agave chrysantha* and *Parthenium incanum*. In addition, the Lime Creek area flora includes one federally listed endangered species, *Purshia* ×*subintegra*, and two rare species of concern, *Eriogonum ripleyi* and *Lotus mearnsii* var. *equisolensis*, occur in the survey area.

INTRODUCTION

The Lime Creek study site (LCSS) is an area of limestone rocks degraded to various degrees that were originally formed in the Tertiary geologic period as deposits in a small lake. Similar deposits are found throughout the Southwest; these have been found to support an unusual assemblage of plant species (Anderson 1992). Although studies of the rare and endemic plants of these lacustrian soils have been conducted, to the best of our knowledge, this study is the first comprehensive inventory of the vascular plants growing in any such area. An inventory of all the plants, or flora, of an area is a valuable tool for land managers. This is especially the case when the area supports rare or endangered species that require special attention. Thus, we decided, after being encouraged by our colleagues, that a study of the LCSS flora would be a useful contribution.

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SURVEY AREA

Area boundaries—The LCSS (Fig. 1) is located about 40 miles northeast of Phoenix between 33° 53' and 33° 54' north latitude and between 111° 42' and 111° 45' west longitude and covers about 1280 acres or two square miles. The area is south of Horseshoe Reservoir along the Verde River, and runs southeast to northwest along the jeep trail crossing Lime creek, with access from Horseshoe Dam and Bartlett Dam Roads. The LCSS is near the reservoir and exhibits rare to infrequent use; this is most frequently noticed along the jeep trail and includes vehicular and horse traffic, target practice, and camping.

Topography, geology, and soils—The elevation of the LCSS ranges from the bed of Lime Creek at 563 m (1850 ft) to the highest point located north of Lime Creek at 734 m (2409 ft). The terrain includes part of Lime Creek, rolling hills, ridges, washes, and one perennial spring (see "Springs" in Fig. 1; hereafter the Spring). The survey area falls in the USGS Horseshoe Dam 7.5' Quadrangle, Maricopa, Arizona County map (Ferguson et al. 1999), and geologically consists of a Tertiary stratigraphic sequence with basaltic lava, conglomerate, sandstone, and lesser amounts of mudstone, limestone and felsic tuff. The younger sequence consists of volcaniclastic conglomerate interbedded with sandstone, fine-grained lacustrine, siliciclastic and carbonate rocks and several discontinuous and relatively thin basalt flows (Ferguson et al. 1999). The lacustrine unit of Horseshoe Dam quadrangle was originally mapped as a calcareous tuff (Wrucke and Conway 1987). Ferguson et al. (1999) found little evidence of pyroclastic textures in these rocks and reinterpreted the deposit as a lacustrine unit dominated by limestone (LLU), correlating it with the Chalk Mountain limestone a few kilometers to the north. Nations and Stump (1996) refer to this area as an example of a Tertiary basin fill sequence known as the Verde Formation in the Verde Basin. In late Miocene time the Verde drainage system was blocked at the southern end resulting in a closed drainage system. Sedimentation proceeded within the basin. External drainage from the basin was restored in the Pleistocene; thus deposition, with rapid accumulation of carbonate and clastic sediments, continued through the Miocene on into the early Pleistocene. Anderson (1996) determined these lacustrine units to be comparatively infertile with very low levels of phosphorus and nitrogen.

Climate—Amount and seasonality of rainfall are defining characteristics of the Sonoran Desert. Much of the Desert has a bimodal rainfall pattern, though even during the rainy seasons most days are sunny. From December to March frontal storms from the northern Pacific Ocean occasionally bring widespread, gentle rain to the northwestern areas of Arizona's Sonoran Desert. From July to mid-September, the summer monsoon brings surges of wet tropical air and frequent but localized violent thunderstorms (Demmitt 1999).

The bimodal weather patterns of the Sonoran Desert promote diverse ephemeral vegetation. The winter rains, when ample, produce large populations of short lived ephemeral plants commonly called "annuals." Normally the annual precipitation is split evenly between the winter and summer rainy seasons (Demmitt 1999). The Flood Control District of Maricopa County (FCDMC; 2008) maintains a gauge at Horseshoe Lake. Recent yearly totals for precipitation are 12.13 inches for

2003, 11.38 inches for 2004, 21.3 inches for 2005, and 10.91 for 2006 inches. During the survey the monthly averages ranged from zero for many months to a high of 5.35 inches in March of 2005 (FCDMC 2008).

The Sonoran Desert differs from the other three North American deserts in having mild winters; most of the Sonoran Desert rarely experiences frost (Demmitt 1999). The FCDMC also maintains a temperature gauge at Horseshoe Lake. The temperature ranged from a low of 22° F in December 2005 to a high of 116° F in July 2005. Mean summer temperatures (June/July/August) were 88° F, while the mean temperature for the winter (December/January) was 52° F (FCDMC 2008).

Historic land use—The survey area lies within the Lower Verde River basin and exhibits evidence of prehistoric use by the agrarian Hohokam people. Evidence of their occupation or use includes temporary collecting camps, field houses, petroglyphs, agricultural fields with check dams and terraces, and quarries (Wood 2006). Quarries were the most common evidence of prehistoric use that we encountered.

In the late 1800s, the region's most valuable resources proved to be mild climate, abundant water, and lush grassland to support cattle operations. One of the first families to establish grazing rights was the Cartwright family who settled on a ranch near what is now Seven Springs Recreational Area in 1887. The LCSS lies completely within the Cartwright grazing allotment. Examination of grazing records indicates that most grazing occurred near and to the west of Lime Creek. This area has not been grazed since 2000 (USDA 2006). While the surrounding hillsides have been grazed for more than 100 years, the exposed LLU is inhospitable to forage plants (Anderson 1996).

Previous botanical studies—No complete floristic work has been published on this area of Tonto National Forest. Botanists made collections between 1960 and 2003 resulting in 70 vouchers. These document the occurrence of 46 taxa. The nearest similar floristic inventory was conducted by Shannon Doan (2002) of the Seven Springs Region of Tonto National Forest.

Vegetation—The Lime Creek region lies within the boundaries of the Arizona Upland Subdivision of the Sonoran Desertscrub Biotic Community as described by Turner and Brown (1994). The flora of the LCSS is unique in that it includes some species (*Juniperus coahuilensis, Rhus ovata*) normally encountered at higher elevations, which are presumed to be relicts of a Miocene pine-oak-juniper woodland that once inhabited the area; others that are endemics to the exposed LLU (*Lotus mearnsii* var. *equisolensis, Purshia* ×*subintegra*); and finally species that are disjuncts from both higher elevations and other deserts (*Eriogonum ripleyi, Lesquerella cinerea, Packera neomexicana, Polygala rusbyi, Polygala macradenia, Polygala scoparioides, Thamnosma texanum*; Anderson 1996). We here report two more disjuncts, *Parthenium incanum* and *Agave chrysantha.*

Endangered, rare, or sensitive species—*Purshia* ×*subintegra* is the only listed endangered species in this area. *Lotus mearnsii* var. *equisolensis* and *Eriogoum ripleyi* are the rare or sensitive species in this area (Arizona Rare Plant Committee 1999).

METHODS

Herbarium searches—The Southwest Environmental Information Network (SEINet; 2007) database was queried using the boundaries of our survey area to produce a list of specimens deposited with University of Arizona Herbarium (ARIZ) and Arizona State University Herbarium (ASU). We were able to study these specimens by examining them ourselves when the specimens were sent on loan (ARIZ) or we were able to visit the herbarium (ASU). A manual search was conducted at Tonto National Forest office of the Terrestrial Ecological Unit Survey Herbarium (TEUI) in the fall of 2006. A similar search was conducted at Desert Botanical Garden Herbarium (DES) in the fall of 2006 and spring of 2007. The identities of all specimens found from the LCSS were verified and annotations were made as necessary.

Collecting methods—The survey area was visited 19 times from September 2003 to September 2006. The entire area was searched on foot in all seasons, excluding the summer months of June and July, for plants in flower and fruit. The most extensive sampling occurred after the summer monsoons and in the spring of each year. Data for each locality, including habitat type, dominant vegetation, and global positioning system (GPS) coordinates and elevation, were recorded for each specimen. Some descriptive information and relative abundance of the plants collected was also noted. Place and road names follow those assigned on TNF maps. Using standard methods, voucher specimens were pressed, dried, mounted, and then deposited with DES. Duplicate vouchers, when available, were sent to ASU and TEIU.

Plant identifications, nomenclature, and archiving of data—*Arizona Flora* (Kearney et al. 1960) was the basic reference for identification, but was superseded by new treatments for the *Manual of Vascular Plants of Arizona* (in progress) as published in the *Journal of the Arizona-Nevada Academy of Science,* 1992–2003 or in *Canotia*, 2005–2009 (Vascular Plants of Arizona Editorial Committee 2010). The *Flora of North America* (http://www.fna.org/) was also used when treatments were published.

Nomenclature follows first the recent treatments for Arizona, and then the *Flora of North America* (http://www.fna.org/). Taxa not covered in these publications follow the United States Department of Agriculture PLANTS database in the World Wide Web (United States Department of Agriculture, Natural Resources Conservation Service 2001; http://plants.usda.gov/). Life form descriptions are based on our observations and on the USDA PLANTS database. Data from all collections were entered in the DES collections database and made publicly available on the World Wide Web at http://swbiodiversity.org/seinet/index.php. Photos taken during the course of the study were printed and mounted on voucher specimens.

Floristic comparison—The floras of the Lime Creek LLU Area and the nearby Seven Springs Recreational Region (Doan 2002) were compared by calculating Jaccard's coefficient of community (Jaccard 1912), which results in a percent similarity metric between the two floras. Geographically the two areas are close, with Seven Springs being less than 3 miles away, but there is no elevational

overlap: Lime Creek LLU area ranges from 1800 feet to about 2300 feet, while the Seven Springs Region ranges from 3300 feet to 5200 feet.

RESULTS AND DISCUSSION

Herbarium searches and collections—Herbarium search results are shown in Table 1. Previous collections (mentioned above) yielded 46 taxa. In our survey we found most of these again. There were four taxa collected previously that were not recollected during this survey: *Astragalus tephrodes* var. *brachylobus*, *Encelia frutescens, Lupinus arizonicus*, and *Penstemon eatonii* var. *undosus.*

Plant collections—During the 37-month survey period, 565 collections were made. Including specimens found during the herbarium searches, the flora of LCSS comprises 271 species in 199 genera of 68 families (Table 2). The best-represented families (Table 3) are, in descending order: Asteraceae, Poaceae, Fabaceae, and Brassicaceae. Introduced species (Table 4) numbered 17, representing 6% of the flora.

The current survey added 225 taxa to the known vascular flora of the LCSS, a five-fold increase. Although there were no new, endangered, rare or sensitive species found during this survey, a few known taxa do warrant mention. *Agave chrysantha,* a disjunct of higher elevation was found in several locations. Whenever found, this plant exhibits cloning, which is an infrequent form of reproduction for this species (Hodgson, pers. com.). *Juniperus coahuilensis* and *Rhus ovata,* presumed relicts of a Miocene pine-oak-juniper woodland (Anderson 1996), were also found in several locations. The only recorded Maricopa County collection of *Parthenium incanum* was made during this survey. Also included in this flora catalog are the only Maricopa County collections of *Eriogonum ripleyi, Lesquerella cinerea, Lotus mearnsii* var. *equisolensis, Polygala rusbyi, Polygala scoparioides, Purshia* ×*subintegra, Thamnosma texana,* all collected by earlier workers and recollected by the authors.

Lime Creek and the Spring comprise habitats that foster uncommon communities of plants within the survey area. *Fraxinus anomala, Juglans major, Prosopis velutina, Parkinsonia florida, Salix gooddingii* and the introduced *Tamarix ramosssima* were found in Lime Creek and surrounding drainage areas. Of the 17 introduced taxa collected during this survey, 8 were found only in Lime Creek and the surrounding drainage. In addition *Ambrosia monogyra* and *Chilopsis linearis* var. *arcuata* were found only in the Lime Creek drainage area. *Typha domingensis* was found only at the Spring.

Life form descriptions are perennial herbs, ephemerals, shrubs, trees, stem succulents, leaf succulents, vines and parasites. Perennial herbs (Table 5) account for 79 species, while ephemerals number 114. Six main habitat types or communities were observed during the course of the survey. Their descriptions and designations are: hills and slopes (HILL), ridges (RIDGE), roads and trails (ROAD), rocks (ROCK), dry washes (WASH), and wetlands including Lime Creek, its borders and the spring (WET). There were 50 taxa (18%) that were found only in the habitat designated WET.

Floristic evaluation of richness—Using Bowers and McLaughlin's (1982) formula for predicting the number of species expected based on elevational range

and collecting time, where '*S*' is the estimated richness, '*E*' is the range in elevation in meters, and '*T*' is the time of collection to the nearest 0.5 years:

$$\hat{S} = 47 + 0.349E + 8.2T$$

For the Lime Creek LLU Area flora, the equation results are:

$$47 + 0.349(160) + 8.2(3) = 121.$$

The actual number of taxa collected by these authors is 227 indicating that there are other factors contributing to the Lime Creek LLU Area's richness besides elevational range and collecting time.

Bowers and McLaughlin (1982) derived an expression of relative richness for Arizona floras examined, where '*R*' is relative richness and '*S*' is the observed number of species:

$$R = 100(S - \hat{S}) \div \hat{S}$$

Applied to the current flora, the following equation results:

$$100(227 - 121) \div 121 = 88$$

R-values express the extent to which factors other than elevational range and collecting time contribute to the absolute diversity of the area. Therefore an R-value of 88 means that there are 88% more species in the survey area than would be expected based on the elevational gradient and collecting time. The perennial supply of water in Lime Creek and at the Spring, and the unique LLU may be contributing factors to the actual number of species found. The winter-spring precipitation, especially the unusually heavy rains in 2005, accompanied by mild temperatures, contributed to diverse, numerous spring ephemerals that year. Spring ephemerals account for about 34% of the total flora. The winter-spring precipitation, especially the unusually heavy rains in 2005, accompanied by mild temperatures contributed to diverse, numerous spring ephemerals, comprising about one-third (34%) of the total flora, and undoubtedly contributed to the overall richness.

Floristic comparison—Jaccard's index (1912) was used to calculate the percent similarity between the flora of the Lime Creek LLU Area and that of the flora of the nearby Seven Springs Recreational Region (Doan 2002). Comparing the flora, a percent similarity can be determined by calculating Jaccard's coefficient of community (Jaccard 1912):

$$J = \{\text{number of taxa in common}/[(\text{total taxa in first flora} + \text{total taxa in second flora}) - \text{number of taxa in common}]\} \times 100$$

The equation results are:

$$\{171/[(271 + 444) - 171]\} \times 100 = 31.4\%$$

Elevation gradient seems to be one of the factors most influential in relative species richness among Arizona regional floras (Bowers and McLaughlin 1982). The calculations made to determine percent similarity between the current flora and the flora for the Seven Springs Region (Doan 2002) indicates other factors might be influencing both the richness and the percent similarity. Geographically the two areas are close with Seven Springs being less than 3 miles away, but there is no elevational overlap. The elevation for the Lime Creek LLU area ranges from 1800 feet to about 2300 feet, while the Seven Springs Region ranges from 3300 feet to 5200 feet. Nevertheless, these two areas show a moderate percent similarity (31.4%). In addition to proximity, the presence of a perennial water supply and the exposed LLU in the area of Lime Creek may offer environments for overlap of vegetation yielding this similarity.

Parabotanist training—This survey began as a suggestion by our colleagues to conduct a flora study of the LCSS as a useful contribution in understanding the floras of the lacustrian soils found at the site. We also set out to determine if training lay men and women as parabotanists (in this case ourselves) is a viable plan to increase the knowledge of Arizona's flora. The experience was a learning process and both of us are still actively involved in collecting in Arizona. The success of this project has encouraged the Arizona Native Plants Society to begin a parabotanist program modeled after the San Diego County Plant Atlas project (SDCPAP 2005).

Table 1. Results of herbarium searches for vascular plant specimens from the Lime Creek area.

Collectors	# of Specimens	Herbarium
Karen Adams & John Welch	7	University of Arizona (ARIZ)
John Anderson	18	Arizona State University (ASU)
Dixie Damrel & the TEUI team	17	Terrestrial Ecological Unit Inventory (TEUI)
Shannon Doan	18	Desert Botanical Garden (DES)
Wendy Hodgson	8	Arizona State University (ASU)
Richard Spellenberg	2	University of Arizona (ARIZ)

Table 2. Taxonomic composition of the Lime Creek LLU area flora (*includes three varieties of *Aristida purpurea*).

Taxonomic Group	Families	Genera	Species
Polypodiophyta	1	2	2
Pinophyta	1	1	1
Magnoliophyta, Magnoliopsida	61	168	232
Magnoliophyta, Liliopsida	5	28	36*
Totals	**68**	**199**	**271***

Table 3. The best represented families composing the Lime Creek LLU area flora (*includes three varieties of *Aristida purpurea*).

Taxonomic Group	Genera	Species	Percent of Total
Asteraceae	37	43	16.0%
Poaceae	22	30*	11.0%
Fabaceae	14	25	9.0%
Brassicaceae	9	11	4.0%
Boraginaceae	6	9	3.3%
Cactaceae	6	9	3.3%
Solanaceae	6	9	3.3%
Hydrophyllaceae	4	9	3.3%

Table 4. Number of introduced plant taxa, by family, in the Lime Creek LLU area flora.

Family	Number of Taxa
Poaceae	7
Asteraceae	2
Brassicaceae	2
Caryophyllaceae	1
Chenopodiaceae	1
Fabaceae	1
Geraniaceae	1
Lamiaceae	1
Tamaricaceae	1

Table 5. Number of plant taxa, by life form, in the Lime Creek LLU area flora.

Life Form	Number of Taxa
Ephemerals	114
Perennial Herbs	79
Shrubs	43
Trees	14
Stem Succulents	9
Vines	7
Parasites	3
Leaf Succulents	2

CATALOG OF VASCULAR PLANTS IN THE AREA OF LIME CREEK, MARICOPA COUNTY, ARIZONA

POLYPODIOPHYTA (FERNS)

Pteridaceae

Astrolepis cochisensis (Goodd.) D. M. Benhan & Windham ssp. *cochisensis* – Cochise Scaly Cloakfern. (N) (PH) Rare, 2100 ft. LLU; ROCK, WASH; *DG208, 256.*

Pellaea truncata Goodd. – Spiny Cliffbrake. (N) (PH) Rare, 2297 ft. MIXED; ROCK; *DG66.*

PINOPHYTA (GYMNOSPERMS)

Cupressaceae

Juniperus coahuilensis (Martinez) Gaussen ex R. P.Adams – Redberry Juniper. (N) (T) Occasional to frequent, 2063–2128 ft. LLU; RIDGE; *DG206, 230.*

MAGNOLIOPHYTA (ANGIOSPERMS)

MAGNOLIOPSIDA (DICOTYLEDONS)

Acanthaceae

Anisacanthus thurberi A. Gray – Thurber's Desert Honeysuckle. (N) (S) Rare, 2042 ft. AL; WET; *DG160.*

Amaranthaceae

Amaranthus palmeri S. Watson – Carelessweed. (N) (E) Infrequent, 2042 ft. MIXED; ROAD; *DG527.*

Anacardiaceae

Rhus ovata S. Watson – Sugar Sumac. (N) (T) Infrequent, 2060–2297 ft. LLU; HILL, RIDGE; *DG223, 324, 380.*

Apiaceae

Daucus pusillus Michx. – American Wild Carrot. (N) (E) Frequent, 1960–2339 ft. ALL; WET, ROAD, HILL; *DG118, 155, 358, 405, 453, SD1486.*

Lomatium nevadense J. M. Coult. & Rose – Nevada Biscuit Root. (N) (PH) Rare, 2036 ft. MIXED; WASH; *DG273b.*

Yabea microcarpa Koso-Pol. – False Carrot. (N) (E) Rare, 2355 ft. LLU; HILL; *DG446.*

Apocynaceae

Amsonia palmeri A. Gray – Palmer's Bluestar. (N) (PH) Infrequent, 2161 ft. LLU; HILL; *DG462, DZD1893-b, JLA87-16.*

Aristolochiaceae

Aristolochia watsoni Wooton & Standl. – Watson's Dutchman's Pipe. (N) (PH) Rare, 1999 ft. LLU; ROAD; *DG205j.*

Asclepiadaceae

Funastrum cynanchoides (Decne.) Schltr. ssp. *heterophyllum* (Engelm. ex. Torr.) Kartesz – Hartweg's Twinevine. (N) (V) Rare, 2042 ft. AL; WET; *DG159.*

Matelea parvifolia (Torr.) Woodson – Spearleaf. (N) (V) Occasional, 2128–2218 ft. MIXED, LLU; HILL; *DG04, 431.*

Asteraceae

Acamptopappus sphaerocephalus (Harr.& A. Gray ex A. Gray) A. Gray var. *sphaerocephalus* – Rayless Goldenhead. (N) (S) Frequent, 1994–2138 ft. LLU, MIXED; HILL, ROAD; *DG149, 394, 494, DZD1905-b SD1493.*

Acourtia wrightii (A. Gray) Reveal & R. M. King – Brownfoot. (N) (PH) Occasional, 2209–2220 ft. LLU; HILL, ROAD; *DG192, 475, JW20-92.*

Adenophyllum porophylloides (A. Gray) Strother – San Felipe Dogweed. (N) (S) Rare, 2128 ft. LLU; ROAD; *DG417.*

Ambrosia confertiflora DC. – Weakleaf Burr Ragweed. (N) (PH) Frequent, 2120–2231 ft. AL, MIXED; ROAD, WET; *DG13, 520, 521.*

Ambrosia deltoidea (Torr.) W. W. Payne – Triangle Burr Ragweed. (N) (S) Rare, 2067 ft. LLU, HILL; *DG506.*

Ambrosia dumosa (A. Gray) W. W. Payne – Burrobush. (N) (S) Rare, 2067 ft. LLU; HILL; *DG504.*

Ambrosia monogyra (Torr. & A. Gray) Strother & B. G.Baldwin [Syn. *Hymenoclea mongyra* Torr. & A. Gray ex A. Gray] – Singlewhorl Burrobush. (N) (S) Frequent, especially in the creek bed. 1996 ft. AL; WET; *DG45.*

Artemisia ludoviciana Nutt. ssp. *mexicana* (Willd. ex Spreng.) D. D. Keck – White Sagebrush. (N) (PH) Rare, 2013 ft. AL; WET; *DG56.*

Baccharis salicifolia (Ruiz & Pav.) Pers. – Mule's Fat. (N) (S) Infrequent, 2075–2091 ft. AL, LLU; RIDGE, WET; *DG59, 332.*

Baccharis sarothroides A. Gray – Desert Broom. (N) (S) Infrequent, 2013–2124 ft. AL, LLU; ROCK, WET; *DG55, 554.*

Baccharis sergiloides A. Gray – Desert Baccharis. (N) (S) Rare, 2000 ft. AL; WET; *DG77.*

Bahiopsis parishii (Greene) E. E. Schill. & Panero [Syn. *Viguiera parishii* Greene] – Parish's Goldeneye. (N) (S) Frequent, 2013–2275 ft. LLU, MIXED; RIDGE, ROAD, WASH; *DG146, 384, 525.*

Baileya multiradiata Harv. & A. Gray ex Torr. – Desert Marigold. (N) (PH) Infrequent, 2013–2060 ft. AL, LLU; RIDGE, WET; *DG52, 224, 348.*

Bebbia juncea Greene – Chuckawalla's Delight. (N) (S) Infrequent, 2016–2278 ft. AL, LLU; ROAD, WET; *DG216, 524, 566.*

Centaurea melitensis L. – Maltese Star-thistle. (I) (E) Rare, 2063 ft. LLU; HILL; *DG514.*

Chaenactis carphoclinia A. Gray – Pebble Pincushion. (N) (E) Occasional, 2067 ft. LLU; HILL; *DG500.*

Conyza canadensis (L.) Cronquist – Canadian Horseweed. (N) (E) Infrequent, 1996 ft. AL; WET; *DG43.*

Dieteria asteroides Torr. var. *glandulosa* (B. L. Turner) D. R. Morgan & R. L. Hartm. (Syn. *Machaeranthera asteroides* (Torr.) Greene) – Fall Tansyaster. (N) (PH) Rare, 2042 ft. AL; WET; *DG158.*

Encelia farinosa A. Gray ex Torr.– Brittlebush. (N) (S) Frequent, 1998–2080 ft. LLU; HILL, RIDGE; *DG133, 286, 327, 345.*

Encelia virginensis A. Nelson – Virgin River Brittlebush. (N) (S) Absent, 2004 ft. LLU; HILL; *SD1494.*

Erigeron divergens Torr. & A. Gray – Spreading Fleabane. (N) (E) Rare, 1996 ft. AL; WET; *DG40.*

Eriophyllum lanosum A. Gray [Syn. *Antheropeas lanosum* (A. Gray) Rydb.] – White Easter Bonnets. (N) (E) Occasional, 1994–2002 ft. MIXED; ROAD; *DG100, 402.*

Gutierrezia sarothrae (Pursh) Britton & Rusby – Broom Snakeweed. (N) (S) Frequent, 2013–2050 ft. AL, LLU; ROAD, WET; *DG51, 224a, 538, JW17-92.*

Helianthus annuus L. – Common Sunflower. (N) (E) Rare, 2056 ft. AL; WET; *DG581.*

Heliomeris longifolius Cockerell var. *annuus* (M. E. Jones) H. O. Yates – Longleaf False Goldeneye. (N) (E) Frequent, 2138–2294 ft. LLU; ROAD; *DG21, 485, 534.*

Heterotheca subaxillaris (Lam.) Britton & Rusby var. *latifolia* (Buckley) Gandhi & R. D. Thomas – Camphorweed. (N) (E) Infrequent, 1996–2041 ft. AL; WET; *DG47.*

Isocoma acradenia (Greene) Greene var. *acradenia* – Alkali Goldbush. (N) (S) Frequent, 1978 ft. ROAD; *DG27.*

Machaeranthera tagetina Greene – Mesa Tansyaster. (N) (E) Occasional, 2013–2231 ft. AL, LLU; ROAD, WET; *DG16, 54.*

Melampodium leucanthum Torr. & A. Gray – Plains Blackfoot Daisy. (N) (PH) Abundant, 1979–2209 ft. LLU; HILL, RIDGE; *DG178, 193, 260, 326, JLA 86-3.*

Monoptilon bellioides H. M. Hall – Mohave Desert Star. (N) (E) Occasional, 1960–2002 ft. MIXED; ROAD, WASH; *DG101, 121.*

Packera neomexicana (A. Gray) W. A. Weber & A. Love var. *neomexicana* – New Mexico Groundsel. (N) (PH) Occasional, 2135–2339 ft. LLU; HILL, ROAD; *DG205h, 452, 490, JLA86-13, 86-18.*

Parthenium incanum Kunth – Mariola. (N) (S) Rare, 2100–2293 ft. LLU; RIDGE; *DG73, DG209.*

Porophyllum gracile Benth. – Slender Poreleaf. (N) (S) Frequent, 1998–2220 ft. AL, LLU; HILL, RIDGE, ROAD, WET; *DG58, 132, 353, 474, 511.*

Psilostrophe cooperi Greene – Whitestem Paperflower. (N) (PH) Occasional, 1994–2257 ft. MIXED, LLU; RIDGE, ROAD; *DG25, 252, 371, 396.*

Rafinesquia neomexicana A. Gray – New Mexico Plumseed. (N) (E) Occasional, 1960–2267 ft. LLU, MIXED; RIDGE, ROAD; *DG112, 376.*

Senecio flaccidus Less. var. *monoensis* (Greene) B. L. Turner & T. M. Barkley. – Smooth Threadleaf Ragwort. (N) (PH) Frequent, 2013–2042 ft. AL; WET; *DG49, 168.*

Sonchus oleraceus L. – Common Sowthistle. (I) (E) Frequent, 2036–2069 ft. AL; WET; *DG169, 272, 322.*

Stephanomeria pauciflora (Torr.) A. Nelson – Brownplume Wirelettuce. (N) (S) Infrequent, 2013–2067 ft. AL, MIXED; WET, ROAD; *DG50, 497.*

Stylocline micropoides A. Gray – Woolyhead Neststraw. (N) (E) Occasional, 1960–2054 ft. LLU, MIXED; RIDGE, ROAD; *DG117, 352, 403.*

Thymophylla acerosa (DC.) Strother – Pricklyleaf Dogweed. (N) (S) Abundant, 2027–2220 ft. LLU; HILL, RIDGE; *DG190, 194, 280, 459, 479.*

Trixis californica Kellogg – American Threefold. (N) (S) Rare, 2355 ft. LLU; HILL; *DG438.*

Uropappus lindleyi Nutt. – Lindley's Silverpuff. (N) (E) Occasional, 1998–2119 ft. LLU; RIDGE, ROAD; *DG130, 310, 355.*

Xanthisma spinulosum (Pursh) Morgan & R. L. Hartm. var. *gooddingii* (A. Nelson) D. R. Morgan & R. L. Hartm. [Syn. *Machaeranthera pinnatifida* (Hook.) Shinners] – Lacy Tansyaster. (N) (PH) Occasional, 2067–2355 ft. LLU; HILL, RIDGE; *DG369, 436, 505, 544, DZD1895-b.*

Berberidaceae

Berberis haematocarpa Wooton – Red Barberry. (N) (S) Rare, 2078 ft. LLU; RIDGE; *DG186a.*

Bignoniaceae

Chilopsis linearis (Cav.) Sweet ssp. *arcuata* (Fosberg) Henrickson – Desert Willow. (N) (T) Rare, 2000 ft. AL; WET; *DG71.*

Boraginaceae

Amsinckia menziesii A. Nelson & J. F. Macbr. var. *intermedia* (Fisch & C. A. Mey) Ganders – Menzie's Fiddleneck. (N) (E) Abundant, 1958–2119 ft. AL, MIXED; HILL, RIDGE, ROAD, WASH, WET; *DG82, 91, 129b, 265, 305, 341.*

Cryptantha barbigera Greene – Bearded Cryptanth. (N) (E) Occasional, 1958–2220 ft. LLU, MIXED; HILL, ROAD; *DG88, 484, SD1488.*

Cryptantha maritima Greene – Guadalupe Cryptantha. (N) (E) Rare, 1998 ft. MIXED; WASH; *DG130b.*

Cryptantha muricata A. Nelson & J. F. Macbr. - Pointed *Cryptantha.* (N) (E) Occasional, 1960–2355 ft. LLU, MIXED; HILL, RIDGE, ROAD; *DG128, 281, 444.*

Heliotropium curassavicum L. var. *oculatum* DC. – Salt Heliotrope. (N) (E) Rare, 2041 ft. AL; WET; *DG219.*

Pectocarya recurvata I. M. Johnston – Curvenut Combseed (N) (E) Frequent, 2002–2042 ft. LLU; RIDGE, ROAD; *DG109, 269.*

Pectocarya platycarpa Munz & I. M. Johnst. – Broadfruit Combseed. (N) (E) Frequent, 2002–2049 ft. LLU, MIXED; RIDGE, WASH; *DG110a, 267.*

Plagiobothrys arizonicus (A. Gray) Greene ex. A. Gray – Arizona Popcorn Flower. (N) (E) Abundant, 1960–2128 ft. ALL; RIDGE, ROAD, WASH, WET; *DG81, 127, 152, 339, 423, SD1487.*

Tiquilia canescens (DC.) A. T. Richardson – Woody Crinklemat. (N) (S) Frequent, 2138–2235 ft. LLU; HILL, RIDGE; *DG195, 368, 439, 477, DZD1903-b.*

Brassicaceae

Boechera perennans (S. Watson) W. A. Weber – Perennial Rockcress. (N) (PH) Infrequent, 2110 ft. AL; WASH, WET; *DG258, 315.*

Brassica tournefortii Gouan – Asian Mustard. (I) (E) Occasional, 2002–2069 ft. AL, MIXED; WASH, WET; *DG99, 319.*

Caulanthus lasiophylla (Hook. & Arn.) Greene – California Mustard. (N) (E) Abundant, 1974–2297 ft. LLU; HILL, RIDGE, ROAD; *DG237, 263, 312, 379, 419.*

Descurainia pinnata (Walter) Britton – Western Tansymustard. (N) (E) Occasional, 1974–2119 ft. LLU, MIXED; HILL, ROAD, WASH; *DG105, 238, 306.*

Draba cuneifolia Nutt. ex Torr. & A. Gray – Wedgeleaf Draba. (N) (E) Abundant, 1992–2161 ft. LLU, MIXED; HILL, RIDGE, ROAD, WASH; *DG102, 246, 279, 328, 461.*

Lepidium lasiocarpum Nutt. ex Torr. & A. Gray – Shaggyfruit Pepperweed. (N) (E) Frequent, 1960–2054 ft. LLU, MIXED; HILL, RIDGE, ROAD, WASH; *DG107, 116, 234, 351.*

Lepidium cf. *oblongum* Small – Veiny Pepperweed. (N) (E) Rare, 1958 ft. MIXED; ROAD; *DG89.*

Lesquerella cinerea S. Watson – Basin Bladderpod. (N) (PH) Abundant, 1979–2339 ft. LLU; HILL, RIDGE, ROAD; *DG179, 205g, 262, 381, 455, 472, DZD1891-b, JLA99-7.*

Lesquerella gordonii (A. Gray) S. Watson – Gordon's Bladderpod. (N) (E) Rare, 2069 ft. AL; WET; *DG320.*

Sisymbrium irio Crantz ex Steud. – London Rocket. (I) (E) Rare, 1979 ft. MIXED; HILL; *DG239.*

Thysanocarpus curvipes Hook. – Sand Fringepod. (N) (E) Occasional, 1992–2119 ft. AL, MIXED; ROAD, WET; *DG243, 308.*

Cactaceae

Carnegiea gigantea (Engelm.) Britton & Rose. – Saguaro. (N) (SS) Frequent 2067 ft. MIXED; ROAD; *DG582.*

Cylindropuntia acanthocarpa (Engelm. & J. M. Bigelow) F. M. Knuth var. *thornberi* (Thornber & Bonker) Pinkava – Thornber Buckhorn Cholla. (N) (SS) Infrequent, 1999–2249 ft. MIXED; ROAD. *DG35, 205a, WCH7230.*

Cylindropuntia bigelovii (Engelm.) F. M. Knuth – Teddybear Cholla. (N) (SS) Infrequent, 2016 ft. MIXED; ROAD; *DG583.*

Cylindropuntia leptocaulis (DC.) F. M. Knuth – Christmas Cactus. (N) (SS) Frequent, 1963–2060 ft. LLU, MIXED; RIDGE, ROAD; *DG79, 229a, 270.*

Echinocereus engelmannii (Parry ex Engelm.) Lemaire ssp. *engelmannii* – Engelman's Hedgehog. (N) (SS) Infrequent, 1994 ft. LLU, MIXED; HILL, ROAD; *DG138, 404.*

Ferocactus cylindraceus (Engelm.) Orcutt – California Barrel Cactus. (N) (SS) Infrequent, 2067–2294 ft. MIXED; ROAD, WASH; *DG24, 508.*

Mammillaria grahamii Engelm. – Arizona Pincushion. (N) (SS) Infrequent, 2063 ft. LLU; HILL, ROAD; *DG231, 507.*

Opuntia engelmannii Salm.-Dyck var. *engelmannii* – Cactus Apple. (N) (SS) Frequent, 2013 ft. MIXED; WASH; *DG142.*

Opuntia phaeacantha Engelm. – Tulip Pricklypear. (N) (SS) Frequent, 2209 ft. LLU; HILL; *DG191.*

Campanulaceae

Nemacladus glanduliferus Jeps. var. *orientalis* McVaugh – Glandular Threadplant. (N) (E) Frequent, 1994–2355 ft. LLU, MIXED; HILL, RIDGE, ROAD; *DG373, 399, 433, 480, DZD1904-b, SD1495.*

Capparidaceae

Polanisia dodecandra (L.) DC. ssp. *trachysperma* (Torr. & A. Gray) Iltis – Sandy Clammyweed. (N) (E) Rare, 1996 ft. AL; WET; *DG39.*

Caryophyllaceae

Herniaria hirsuta L. var. *cinera* (DC.) Coutinho – Hairy Rupturewort. (I) (E) Frequent, 1994–2355 ft. LLU, MIXED; HILL, ROAD; *DG397, 450, 481, SD1492.*

Silene antirrhina L. – Sleepy Silene. (N) (E) Frequent, 1994–2220 ft. LLU, MIXED; HILL, ROAD; *DG349, 390, 426, 471, DZD1902-b, SD1485.*

Celastraceae

Canotia holacantha Torr. – Crucifixion Thorn. (N) (T) Abundant, 2027–2305 ft. LLU; RIDGE, ROAD; *DG26, 276, 378, 545.*

Chenopodiaceae

Atriplex canescens (Pursh.) Nutt. var. *canescens* – Fourwing Saltbush. (N) (S) Infrequent, 2065–2118 ft. AL, LLU; ROAD, WET; *DG210, 535, 575.*

Atriplex elegans (Moq.) D. Dietr. var. *elegans* – Wheelscale Saltbush. (N) (E) Rare, 2254 ft. LLU; ROAD; *DG07.*

Atriplex polycarpa (Torr.) S. Watson – Cattle Saltbush. (N) (S) Rare, 2120 ft. MIXED; ROAD; *DG518.*

Chenopodium fremontii S. Watson – Fremont's Goosefoot. (N) (E) Rare, 2035 ft. AL; WET; *DG572.*

Chenopodium watsonii A. Nelson – Watson's Goosefoot. (N) (E) Rare, 2080 ft. LLU; HILL; *DG292.*

Salsola tragus L. – Russian Thistle. (I) (E) Infrequent, 1851 ft. AL; WET; *DG38.*

Convolvulaceae

Evolvulus alsinoides L. – Slender Dwarf Morning Glory. (N) (PH) Rare, 2075 ft. AL; WET; *DG62.*

Evolvulus arizonicus A. Gray – Wild Dwarf Morning Glory. (N) (PH) Rare, 2063 ft. LLU; WET; *DG212.*

Evolvulus nuttallianus Schult. – Shaggy Dwarf Morning Glory. (N) (PH) Rare 2078 ft. LLU; RIDGE; *DG185.*

Ipomoea cristulata Hallier f. – Transpecos Morning Glory. (N) (V) Rare, 2047 ft. AL; WET; *DG571.*

Cucurbitaceae

Marah gilensis Greene – Gila Manroot. (N) (V) Rare, 2042-2119 ft. AL; WET; *DG172, 300.*

Cuscutaceae

Cuscuta indecora Choisy – Alfalfa Dodder. (N) (P) Frequent, 2116–2258 ft. LLU; HILL, RIDGE; *DG20, 248, 294, 416.*

Euphorbiaceae

Argythamnia lanceolata Pax & K. Hoffm. – Narrowleaf Silverbush. (N) (S) Rare, 2366 ft. LLU; HILL; *DG74.*

Argythamnia neomexicana Mull. Arg. – New Mexico Silverbush. (N) (E) Infrequent, 2124 ft. LLU; HILL; *DG553.*

Chamaesyce arizonica (Engelm.) Arthur – Arizona Sandmat. (N) (PH) Rare, 2294 ft. LLU; ROAD; *DG18.*

Chamaesyce capitellata Millsp. – Head Sandmat. (N) (PH) Occasional, 2254–2366 ft. LLU; RIDGE, ROAD; *DG08, 78, 211.*

Chamaesyce chaetocalyx (Boiss.) Wooton & Standl. var. *chaetocalyx* – Bristlecup Sandmat. (N) (PH) Occasional, 2220–2339 ft. LLU; HILL; *DG456, 478, WCH7228.*

Chamaesyce florida (Engelm.) Millsp. – Chiricahua Mountain Sandmat. (N) (E) Infrequent, 2056–2231 ft. AL, MIXED; ROCK, WET; *DG15, 579.*

Chamaesyce pediculifera Rose & Standl. – Carrizo Mountain Sandmat. (N) (PH) Rare, 1946 ft. LLU; RIDGE; *DG564.*

Euphorbia heterophylla L. – Mexican Fireplant. (N) (E) Rare, 2056 ft. AL; WET; *DG580.*

Fabaceae

Acacia constricta Benth. var. *paucispina* Woot. & Standl. – White Thorn Acacia. (N) (T) Occasional, 2104–2249 ft. LLU; HILL; *DG33, 205f, 257.*

Acacia greggii A. Gray – Catclaw Acacia. (N) (T) Infrequent, 2042–2135 ft. LLU; WASH, HILL; *DG164, 205e.*

Astragalus lentiginosus Douglas ex Hook. – Freckled Milkvetch. (N) (E) Rare, 2068 ft. AL; WET; *DG334.*

Astragalus nuttallianus Speg. – Small Flowered Milkvetch. (N) (E) Occasional, 1994–2138 ft. LLU, MIXED; RIDGE, ROAD; *DG372, 388, 429, SD1483.*

Astragalus tephrodes A. Gray var. *brachylobus* (A. Gray) Barneby – Ashen Milkvetch. (N) (PH) Absent, LLU; *JLA87-23.*

Astragalus tephrodes A. Gray var. *chloridae* (M. E. Jones) – Ashen Milkvetch. (N) (PH) Infrequent, 2027–2102 ft. LLU, MIXED; HILL, RIDGE; *DG273, 274, 470, 515.*

Calliandra eriophylla Benth. – Fairyduster. (N) (S) Abundant, 1960–2131 ft. LLU; RIDGE, ROAD; *DG124, 228, 277, 360, 558.*

Dalea formosa Torr. – Featherplume. (N) (S) Rare, 2120 ft. LLU: HILL; *DG72.*

Lotus humistratus Greene – Foothill Deervetch. (N) (E) Frequent, 2002–2138 ft. LLU; HILL, RIDGE, WASH; *DG97, 342, 427, 487, SD1490.*

Lotus mearnsii (Britton) Greene var. *equisolensis* J. L. Anderson – Mearns's Bird's-foot Trefoil. (N) (PH) Frequent, 2050–2229 ft. LLU; HILL, RIDGE; *DG293, 382, 509, JLA 86-33, JLA 87-21, WCH7227.*

Lotus rigidus (Benth.) Greene – Shrubby Deervetch. (N) (PH) Frequent, 2013–2104 ft. AL, LLU; HILL, WET; *DG57, 259, 273a.*

Lotus salsuginosus Greene var. *brevivexillus* Ottley – Coastal Bird's-foot Trefoil. (N) (E) Infrequent, 1992–2080 ft. LLU; RIDGE, ROCK; *DG241, 285.*

Lotus strigosous (Nutt.) Greene var. *tomentellus* (Greene) Isely – Strigose Bird's-foot Trefoil. (N) (E) Rare, 2128 ft. LLU; HILL; *DG428.*

Lupinus arizonicus (S. Watson) S. Watson – Arizona Lupine. (N) (E) Absent, WASH; *RS*(sn).

Lupinus brevicaulis Griseb. – Shortstem Lupine. (N) (E) Infrequent, 1994–2138 ft. LLU, MIXED; HILL, ROAD; *DG387, 486.*

Lupinus sparsiflorus Torr. – Mojave Lupine. (N) (E) Occasional, 1998–2069 ft. AL; WASH, WET; *DG92, 136, 316.*

Lupinus succulentus Douglas ex K. Koch – Hollowleaf Annual Lupine. (N) (E) Infrequent, 2027–2102 ft. MIXED; HILL, ROAD; *DG282, 469.*

Marina parryi (A. Gray) Barneby – Parry's False Prairie Clover. (N) (PH) Occasional, 2050–2161 ft. AL, LLU; HILL, WET; *DG65, 231b, 463.*

Medicago polymorpha L. – Burclover. (I) (E) Rare, 2069 ft. AL; WET; *DG318.*

Olneya tesota A. Gray – Desert Ironwood. (N) (T) Rare, 2045 ft. LLU; RIDGE; *DG541a.*

Parkinsonia florida S. Watson – Blue Palo Verde. (N) (T) Rare, 2042 ft. MIXED; WASH; *DG162.*

Prosopis velutina Wooton – Velvet Mesquite. (N) (T) Frequent, 2067–2121 ft. LLU, MIXED; HILL, WASH; *DG189, 503, 555.*

Senna covesii (A. Gray) H. S. Irwin & Barneby – Cove's Cassia (N) (PH) Frequent, 2038–2063 ft. AL, LLU; HILL, WET; *DG213, 231a, 569.*

Tephrosia vicioides Schtdl. – Red Hoarypea. (N) (PH) Rare, 2075 ft. AL; WET; *DG64.*

Vicia ludoviciana Nutt. ex Torr. & A. Gray – Louisiana Vetch. (N) (V) Rare, 2075 ft. LLU; HILL; *DG440, DZD1896-b.*

Fouquieriaceae

Fouquieria splendens Engelm. ssp. *splendens* – Ocotillo. (N) (S) Occasional, 2013 ft. LLU; HILL; *DG143.*

Geraniaceae

Erodium cicutarium L' Her. ex At. – Redstem Stork's Bill. (I) (E) Frequent, 1960–2054 ft. LLU; HILL, ROAD; *DG80, 119, 340.*

Erodium texanum A. Gray – Texas Stork Bill. (N) (E) Frequent, 1994–2138 ft. LLU, MIXED; HILL, ROAD; *DG275, 364, 401.*

Hydrophyllaceae

Emmenanthe penduliflora Benth. – Whispering Bells. (N) (E) Infrequent, 1998–2116 ft. LLU; RIDGE, WASH; *DG131, 156, 299, SD1481.*

Eucrypta chrysanthemifolia Greene var. *bipinnatifida* (Torr.) Constance – Spotted Hideseed. (N) (E) Rare, 1974 ft. LLU; ROCK; *DG240.*

Eucrypta micrantha A. Heller – Dainty Desert Hideseed. (N) (E) Rare, 2355 ft. LLU; HILL; *DG442.*

Phacelia affinis A. Gray – Limestone Phacelia. (N) (E) Occasional, 1979–2091 ft. AL, LLU; HILL, WET; *DG264, 331, 356.*

Phacelia crenulata Torr. ex S. Watson var. *ambigua* (M. E. Jones) J. F. Macbr. [Syn. *Phacelia ambigua* M. E. Jones] – Cleftleaf Wild Heliotrope. (N) (E) Abundant, 1960–2091 ft. LLU, MIXED; HILL, ROAD, WASH; *DG106, 123, 330, 407.*

Phacelia distans Benth. – Distant Phacelia. (N) (E) Infrequent, 2090 ft. LLU; RIDGE; *DG290, 329.*

Phacelia ivesiana Torr. – Ive's Phacelia. (N) (E) Rare, 2355 ft. LLU; HILL; *DG443.*

Phacelia ramosissima Dougl ex Lehm. – Branching Phacelia. (N) (PH) Infrequent, 2138–2154 ft. LLU, MIXED; HILL, ROAD; *DG150, 370.*

Pholistoma auritum (Lindl.) Lilja – Blue Fiestaflower. (N) (E) Rare, 2119 ft. MIXED; ROAD; *DG311.*

Juglandaceae

Juglans major (Torr.) A. Heller – Arizona Walnut. (N) (T) Rare, 2056 ft. AL; WET; *DG576.*

Krameriaceae

Krameria erecta Willd ex Schult. – Littleleaf Ratany. (N) (S) Infrequent, 1983–2209 ft. LLU, MIXED; ROAD; *DG32, 393, KRA07-93.*

Lamiaceae

Hedeoma nana (Torr.) Briq. ssp. *macrocalyx* W. S. Stewart – Dwarf False Pennyroyal. (N) (E) Frequent, 2042–2138 ft. LLU; HILL, ROAD, WASH; *DG161, 181, 205c, 491.*

Lamium amplexicaule L. – Henbit Deadnettle. (I) (E) Rare, 2069 ft. LLU, HILL; *DG323.*

Salvia columbariae Benth. – Chia. (N) (E) Occasional, 1998–2116 ft. LLU; RIDGE, ROAD, WASH; *DG104, 137, 295.*

Linaceae

Linum lewisii Pursh – Lewis Flax. (N) (PH) Occasional, 2054–2339 ft. LLU; HILL, RIDGE; *DG297, 354, 457.*

Linum puberulum (Engelm.) A. Heller – Plains Flax. (N) (E) Occasional, 2078–2209 ft. LLU; HILL; *DG175, 201, DZD1898-b.*

Loasaceae

Mentzelia affinis Greene – Yellowcomet. (N) (E) Rare, 1960 ft. MIXED; ROAD; *DG120.*

Mentzelia multiflora (Nutt.) A. Gray – Adonis Blazingstar. (N) (PH) Occasional, 1996–2273 ft. AL, LLU; HILL, WASH, WET; *DG46, 205d, 516, 533.*

Malpighiaceae

Janusia gracilis A. Gray – Slender Janusia. (N) (V) Frequent, 2120–2294 ft. LLU, MIXED; ROAD; *DG22, 414, 517, 526.*

Malvaceae

Abutilon incanum Sweet – Sweet Pelotazo. (N) (PH) Rare, 2336 ft. LLU; RIDGE; *DG75.*

Herissantia crispa (L.) Briz. – Bladdermallow. (N) (E) Rare, 2056 ft. AL; WET; *DG577.*

Sphaeralcea ambigua A. Gray – Desert Globemallow. (N) (PH) Frequent, 1960 ft. MIXED; ROAD, WASH; *DG113, SD1496.*

Nyctaginaceae

Allionia incarnata L. var. *villosa* (Standl.) B. L. Turner – Trailing Windmills. (N) (PH) Frequent, 2051–2355 ft. AL, LLU; HILL, ROAD, WET; *DG01, 432, 549.*

Mirabilis laevis (Benth.) Curran var. *retrorsa* (A. Heller) Munz [Syn. *Mirabilis bigelovii* A. Gray) – Wishbone-bush. (N) (PH) Occasional, 1974–2080 ft. LLU; HILL, RIDGE; *DG135, 235, 284, SD1491.*

Oleaceae

Fraxinus anomala Torr. ex S. Watson – Single Leaf Ash. (N) (T) Rare, 2069 ft. AL; WET; *DG325.*

Menodora scabra A. Gray – Rough Menodora (N) (PH) Frequent, 1998–2294 ft. LLU; HILL, ROAD; *DG06, 19, 134, 207.*

Onagraceae

Camissonia californica (Nutt. ex Torr. & A. Gray) P.H. Raven – California Suncup. (N) (E) Rare, 2013 ft. LLU; WASH; *DG141.*

Camissonia claviformis (Torr. & Frem.) P. H. Raven ssp. *auratiaca* (S. Watson) Munz – Brown Eyes. (N) (E) Rare, 2002 ft. LLU; WASH; *DG95, SD1484.*

Camissonia micrantha (Hornem. ex Spreng.) P. H. Raven – Minature Suncup. (N) (E) Occasional, 2042–2161 ft. AL, LLU; HILL, ROAD, WET; *DG154, 309, 464.*

Gaura mollis Nutt. ex Torr. – Velvetweed. (N) (E) Rare, 1996 ft. AL; WET; *DG44.*

Oenothera elata Kunth. – Hooker's Evening Primrose. (N) (PH) Rare, 2047 ft. AL; WET; *DG574.*

Oenothera primiveris A. Gray – Desert Evening Primrose. (N) (E) Infrequent, 1963–2002 ft. LLU; ROAD, WASH; *DG83, 93.*

Orobanchaceae

Orobanche cooperi (A. Gray) A. Heller ssp. *cooperi* – Louisiana Broomrape. (N) (P) Rare, 2050 ft. LLU; HILL; *DG510.*

Papaveraceae

Argemone gracilenta Greene – Sonoran Pricklypoppy. (N) (PH) Rare, 2041 ft. AL; WET; *DG217.*

Eschscholzia californica Cham. ssp. *mexicana* (Greene) C. Clark – California Poppy. (N) (E) Occasional, 1998–2138 ft. LLU; RIDGE, ROAD, WASH; *DG94, 129, 283, 302, 367.*

Platystemon californicus Benth. - Cream Cups. (N) (E) Rare, 2068 ft. AL; WET; *DG335.*

Pedaliaceae

Proboscidea parviflora Wooton & Standl. – Devilsclaw. (N) (E) Rare, 2047 ft. AL; WET; *DG570.*

Plantaginaceae

Plantago ovata Phil. – Desert Indianwheat. (N) (E) Frequent, 1963–2138 ft. LLU; HILL, ROAD; *DG85, 346, 489, SD1480.*

Plantago patagonica Bert. ex Steud. – Woolly Plantain. (N) (E) Occasional, 1960–2042 ft. AL, MIXED; ROAD, WET; *DG126, 165, 173.*

Plantago rhodosperma Decne. – Redseed Plantain. (N) (E) Rare, 2138 ft. LLU; HILL. *DG488.*

Polemoniaceae

Eriastrum eremicum (Jeps.) H. Mason – Desert Woollystar. (N) (E) Infrequent, 1960–2138 ft. LLU, MIXED; HILL, ROAD; *DG114, 492.*

Gilia flavocincta A. Nelson ssp. *flavocincta* – Yellowthroat Gilia. (N) (E) Abundant, 1960–2116 ft. LLU; HILL, RIDGE, ROAD, WASH; *DG103, 115, 287, 307, 350, SD1482.*

Leptosiphon aureus (Nutt.) J. M. Porter & L. A. Johnson ssp. *aureus* – Golden Linanthus. (N) (E) Rare, 1994 ft. MIXED; ROAD; *DG400.*

Linanthus bigelovii Greene – Bigelow's Linanthus. (N) (E) Rare, 2355 ft. LLU; HILL; *DG449.*

Phlox tenuifolia E. E. Nelson – Santa Catalina Mountain Phlox. (N) (PH) Rare, 2299 ft. MIXED; ROAD; *DG386.*

Polygalaceae

Polygala macradenia A. Gray – Glandleaf Milkwort. (N) (PH) Infrequent 2078–2209 ft. LLU; HILL; *DG186, 199, 562, DZD1863-b.*

Polygala rusbyi Greene – Rusbyi's Milkwort. (N) (S) Frequent, 2220–2339 ft. LLU; HILL. *DG454, 476, DZD1890-b, JLA87-22.*

Polygala scoparioides Chodat. – Broom Milkwort. (N) (PH) Rare, 2102 ft. LLU; HILL; *DG468, DZD1894-b.*

Polygonaceae

Chorizanthe brevicornu Torr. var. *breicornu* – Brittle Spineflower. (N) (E) Infrequent, 1999–2355 ft. LLU, MIXED; HILL, ROAD; *DG205k, 445.*

Eriogonum arizonicum Gand. – Arizona Buckwheat. (N) (PH) Rare, 2034 ft. LLU, MIXED; ROAD; *DG69, SD1489.*

Eriogonum deflexum Torr. var. *deflexum* –Flatcrown Buckwheat. (N) (E) Frequent, 2013–2212 ft. AL, LLU; HILL, ROAD, WET; *DG02, 48, 502, 542.*

Eriogonum fasciculatum Benth. var. *polifolium* (Benth.) Torr. & A. Gray – Eastern Mohave Buckwheat. (N) (S) Frequent, 2013–2275 ft. LLU, MIXED; HILL, RIDGE, ROAD; *DG147, 291, 365, 532.*

Eriogonum inflatum Torr. – Desert Trumpet. (N) (E) Abundant, 1960–2355 ft. LLU; HILL, ROAD; *DG03, 125, 357, 395, 437, KRA16-92, SD1497.*

Eriogonum ripleyi J. T. Howell – Fraziers Well Buckwheat. (N) (PH) Frequent, 2078–2209 ft. LLU; HILL; *DG180, 204, 561, DZD1899-b, JL86-34, KRA08-93, RS(s. n.), WCH7226.*

Eriogonum trichopes Torr. – Little Desert Trumpet. (N) (E) Infrequent, 1983 ft. ROAD; *DG30.*

Eriogonum wrightii Torr. ex Benth.var. *wrightii* – Bastardsage. (N) (S) Rare, 2013 ft, AL; WET; *DG53.*

Portulacaceae

Calandrinia ciliata DC. – Fringed Redmaids. (N) (E) Occasional, 2068–2116 ft. AL, LLU; ROAD, WET; *DG298, 336, 337.*

Claytonia perfoliata Donn ex Willdenow – Miners Lettuce. (N) (E) Infrequent, 2091 ft. AL; WET; *DG333.*

Ranunculaceae

Anemone tuberosa Rydb. – Tuber Anemone. (N) (PH) Frequent, 2002–2297 ft. LLU; RIDGE, WASH; *DG98, 145, 266, 375.*

Delphinium parishii A. Gray ssp. *parishii* – Desert Larkspur. (N) (PH) Infrequent, 2013–2128 ft. LLU; HILL, ROAD, WASH; *DG144, 409, 420, 499.*

Rhamnaceae

Ceanothus vestitus Greene [Syn. *Ceanothus greggii* A. Gray] – Desert Ceanothus. (N) (S) Frequent, 2100–2220 ft. LLU; HILL, RIDGE; *DG254, 255, 259a, 374, 483.*

Zizyphus obtusifolia (Hook. ex. Torr. & A. Gray) A. Gray var. *canescens* (A. Gray) M. C. Johnst. – Graythorn. (N) (S) Occasional, 2050–2209 ft. LLU; HILL, ROAD; *DG200, 222.*

Roseaceae

Purshia ×subintegra (Kearney) Henrickson [*P. pinkavae* Schaack × *P. stansburyana* (Torr.) Henrickson] (N) (S) Frequent, 2078–2136 ft. LLU; RIDGE; *DG516a, KA/JW 22-92, JLA83-36, JLA86-15, JLA86-16, JLA86-17, JLA86-35, WCH7229.*

Rubiaceae

Galium aparine L. – Cleavers Stickywillie. (N) (E) Rare, 2119 ft. MIXED; ROAD; *DG303.*

Galium proliferum A. Gray – Limestone Bedstraw. (N) (E) Frequent, 2118–2220 ft. LLU; HILL; *DG425, 482, DZD1901-b.*

Galium stellatum Kellogg ssp. *eremicum* Hilend & J. T. Howell – Starry Bedstraw. (N) (PH) Rare, 2172 ft. LLU; HILL; *DG458, JW23-02.*

Rutaceae

Thamnosma texana Torr. – Rue of the Mountains. (N) (PH) Occasional, 2027–2155 ft. LLU; RIDGE; *DG251, 278, JLA87-25.*

Salicaceae

Salix gooddingii Ball – Goodding's Willow. (N) (T) Rare, 2042 ft. AL; WET; *DG167.*

Sapindaceae

Dodonaea viscosa Mart. – Florida Hopbush. (N) (S) Frequent, 2050–2305 ft. AL, LLU; HILL, RIDGE, ROAD, WET; *DG60, 61, 225, 250, 363, 546.*

Scrophulariaceae

Castilleja angustifolia (Nutt.) G. Don var. *dubia* A. Nelson – Wavyleaf Paintbrush. (N) (PH) Infrequent, 2080–2155 ft. LLU; RIDGE; *DG249, 289.*

Castilleja exserta (A. Heller) Chuang & Heckard ssp. *exserta* – Exserted Paintbrush. (N) (E) Frequent to abundant, 1960–2209 ft. LLU; HILL, RIDGE, ROAD; *DG111, 202, 288, 321, 343, 391.*

Castilleja lanata A. Gray ssp. *lanata* – Sierra Woolly Indian Paintbrush. (N) (PH) Rare, 2042 ft. AL; WET; *DG171.*

Keckiella antirrhinoides (Benth.) Straw ssp. *microphylla* (A. Gray) Straw – Snapdragon Penstemon. (N) (S) Rare, 2006 ft. MIXED; ROAD; *DG15, JLA87-19.*

Maurandella antirrhiniflora (Humb. & Bonpl. ex Willd.) Rothm – Roving Sailor. (N) (V) Rare, 2056 ft. AL; WET; *DG215.*

Mimulus guttatus DC. – Seep Monkey Flower. (N) (E) Rare, 2068 ft. AL; WET; *DG385.*

Penstemon eatonii A, Gray ssp. *undosus* (M. E. Jones) D. D. Keck – Firecracker Penstemon (N) (PH) Absent; *JLA97-18.*

Simmondsiaceae

Simmondsia chinensis C. K. Schneid. – Jojoba. (N) (S) Frequent, 1974–2212 ft. AL, LLU; HILL, WET, WASH; *DG05, 148, 236, 314, 359.*

Solanaceae

Chamaesaracha coronopus A. Gray – Greenleaf Five Eyes. (N) (PH) Rare 2050 ft. LLU; ROAD; *DG229b.*

Datura wrightii Regel – Sacred Datura. (N) (E) Infrequent, 2041 ft. AL; WET; *DG218.*

Lycium berlandieri Dunal. – Berlanderi's Wolfberry. (N) (S) Rare 2050 ft. LLU; HILL; *DG232.*

Lycium exsertum A. Gray – Arizona Desert Thorn. (N) (S) Infrequent, 2054–2095 ft. AL, LLU; RIDGE, WET; *DG67, 362, 563.*

Nicotiana obtusifolia M. Martens & Galeotti var. *obtusifolia* – Desert Tobacco. (N) (E) Infrequent, 1851 ft. AL; WET; *DG37, 41.*

Physalis crassifolia Benth. – Yellow Nightshade Groundcherry. (N) (E) Infrequent, 2030–2042 ft. AL; WET; *DG157, 567.*

Physalis hederifolia A. Gray – Ivyleaf Groundcherry. (N) (PH) Rare, 2275 ft. LLU; HILL; *DG523.*
Solanum douglasii Dunal – Greenspot Nightshade. (N) (E) Locally common in creek, 2030 ft.; AL; WET; *DG568.*
Solanum elaeagnifolium Cav. – Silver Nightshade. (N) (PH) Rare 2047 ft. AL; WET; *DG573.*

Sterculiaceae

Ayenia filiformis S. Watson – Trans Pecos Ayenia. (N) (PH) Infrequent, 2056–2366 ft. AL, LLU; RIDGE, WET; *DG76, 214.*

Tamaricaceae

Tamarix ramosissima Karel. ex Boiss. – Saltcedar. (I) (T) Rare, 1851 ft. AL; WET; *DG36.*

Ulmaceae

Celtis ehrenbergiana (Klotzsch) Liebm. [Syn. *Celtis pallida* Torr.] – Desert Hackberry. (N) (T) Infrequent, 2120–2254 ft. LLU, MIXED; ROAD; *DG14, 522.*

Urticaceae

Parietaria hespera Hinton – Rillita Pellitory. (N) (E) Infrequent, 2128 ft. LLU; HILL; *DG424.*
Parietaria pensylvanica Muhlenberg ex. Willd. – Pennsylvania Pellitory. (N) (E) Occasional, 2120 ft. LLU; HILL, RIDGE; *DG296, 496.*

Viscaceae

Phoradendron californicum Nutt. – Mesquite Misletoe. (N) (P) Infrequent, 1992–2119 ft. AL, LLU; HILL, WET; *DG244, 313.*

Verbenaceae

Aloysia wrightii A. Heller – Wright's Beebush. (N) (S) Rare, 2254 ft. LLU, HILL; *DG10.*

Zygophyllaceae

Kallstroemia grandiflora Torr. ex. A. Gray – Arizona Poppy. (N) (E) Rare, 2056 ft. AL; WET; *DG578.*
Larrea tridentata Coville – Creosote Bush. (N) (S) Frequent, 2131–2294 ft. LLU; RIDGE, ROAD; *DG23, 556.*

MAGNOLIOPHYTA (ANGIOSPERMS)

LILIOPSIDA (MONOCOTYLEDONS)

Agavaceae

Agave chrysantha Peeples – Golden Flower Century Plant. (N) (LS) Infrequent, 2128–2297 ft. LLU; HILL, RIDGE, WASH; *DG187, 206a, 377, 565, WCH 17807, 17808.*
Yucca elata (Engelm.) Engelm. var. *elata* – Soaptree Yucca. (N) (LS) Infrequent, 2179–2249 ft. LLU; HILL; *DG34, 548, WCH17810.*

Liliaceae

Calochortus kennedyi Porter var. *kennedyi* – Desert Mariposa Lily. (N) (PH) Frequent to abundant, 2067–2128 ft. LLU; HILL, RIDGE; *DG174, 415, 501, DZD1885-b.*
Dichelostemma capitatum (Benth.) Alph. Wood ssp. *pauciflorum* (Torr.) G. Keator – Bluedicks. (N) (PH) Common, 1960–2119 ft. AL, LLU; HILL, ROAD, WET; *DG110, 242, 304, 338, 347.*

Nolinaceae

Nolina microcarpa S. Watson – Sacahuista. (N) (S) Rare, 2135 ft. LLU; ROAD; *DG205.*

Poaceae

Achnatherum speciosum (Trin. & Rupr.) Barkworth – Desert Needlegrass. (N) (PH) Infrequent, 2118–2220 ft. LLU; HILL; *DG196, 411, 473.*

Aristida adsencionis L. – Sixweeks Threeawn. (N) (E) Rare, 2094 ft. LLU; HILL; *DG467.*

Aristida purpurea Nutt. var. *nealleyi* (Vasey) K. W. Allred – Blue Threeawn. (N) (PH) Infrequent, 2119–2275 ft. LLU; HILL, ROAD; *DG184, 301, 528.*

Aristida purpurea Nutt. var. *parishii* (Hitchc.) K. W. Allred – Parish's Threeawn. (N) (PH) Rare, 2212 ft. ROAD; *DG17.*

Aristida purpurea Nutt. var. *purpurea* – Purple Threeawn. (N) (PH) Rare, 2049 ft. LLU; RIDGE; *DG271.*

Avena fatua Viv. – Wild Oats. (I) (E) Infrequent, 2042–2069 ft. AL, LLU; WET, HILL; *DG166, 317.*

Bothriochloa barbinodis (Lag.) Herter – Cane Bluestem. (N) (PH) Rare, 2055 ft. AL, LLU; RIDGE, WET; *DG231c, 550.*

Bouteloua aristidoides Griseb. – Needle Grama. (N) (E) Rare, 2212 ft. ROAD; *DG12.*

Bouteloua curtipendula Torr. – Sideoats Grama. (N) (PH) Occasional, 2050–2275 ft. ALL; ROAD, WASH, WET; *DG229, 529, 551.*

Bouteloua trifida Thurb. ex S. Watson – Red Grama. (N) (PH) Occasional, 2063–2128 ft. AL, LLU; ROAD, WET; *DG421, 513.*

Bromus rubens Desv. ex Willk. & Lange – Red Brome. (I) (E) Abundant, 1994–2212 ft. LLU, MIXED; HILL, RIDGE; ROAD; *DG392, 413, 495, 539, 543.*

Dasyochloa pulchella (Kunth) Willd. ex Rydb. – Low Woollygrass. (N) (PH) Frequent, 1983–2094 ft. LLU, MIXED; ROAD, RIDGE, WASH; *DG31, 245, 389, 465.*

Distichlis spicata Greene – Saltgrass. (N) (PH) Rare, 1983 ft. LLU; ROAD; *DG29.*

Elymus elymoides (Raf.) Swezey – Squirreltail. (N) (PH) Rare, 2128 ft. LLU; RIDGE; *DG412.*

Eragrostis lehmanniana Nees – Lehmann's Lovegrass. (I) (PH) Rare, 2034 ft. AL; WET; *DG70.*

Hesperostipa neomexicana (Thurb. & Coult.) Barkworth – New Mexico Feathergrass. (N) (PH) Rare, 2128 ft. LLU; HILL; *DG410.*

Hilaria belangeri (Steud.) Nash – Curly-Mesquite. (N) (PH) Abundant, 2045–2231 ft. LLU; HILL, ROAD; *DG11, 183, 383, 519, 537.*

Hordeum murinum L. ssp. *glaucum* (Steud.) Tzvelev – Smooth Barley. (I) (E) Rare, 2355 ft. LLU; HILL; *DG434.*

Hordeum pusillum Nutt. – Little Barley. (N) (PH) Occasional, 2138–2355 ft. LLU; HILL; *DG435, 498.*

Leptochloa panicea (de Retz) Owhi ssp. *brachiata* (Steud.) N. Snow – Mucronate Spangletop. (N) (E) Infrequent, 2260 ft. ROAD; *DG09, 530.*

Pennisetum setaceum (Forssk.) Chiov. – Crimson Fountain Grass (I) (PH) Rare, 2051 ft. AL; WET; *DG552.*

Pleuraphis mutica Buckley – Tobosagrass. (N) (PH) Rare, 2094 ft. LLU; HILL; *DG466.*

Pleuraphis rigida Thurb. – Big Galleta. (N) (PH) Rare, 2060–2275 ft. ROAD; *DG226, 531, DZD1892-b.*

Poa bigelovii Vasey & Scribn. – Bigelow's Bluegrass. (N) (E) Infrequent, 2054–2355 ft. LLU; HILL; *DG361, 447.*

Schismus arabicus Nees – Arabian Schismus. (I) (E) Rare, 1979 ft. LLU; RIDGE; *DG261.*

Schismus barbatus (L.) Juel – Common Mediterranean Grass. (I) (E) Rare, 2355 ft. LLU; HILL; *DG441.*

Sporobolus airoides Torr. – Alkali Sacaton. (N) (PH) Rare, 1978 ft. ROAD; *DG28.*

Tridens muticus Nash – Slim Tridens. (N) (PH) Frequent, 2128–2409 ft. LLU; HILL, RIDGE; *DG227, 422, 547, 557.*

Trisetum interruptum Buckley – Prairie False-oat. (N) (E) Rare, 2128 ft. LLU; HILL; *DG418.*

Vulpia octoflora Rydb. – Sixweeks Fescue. (N) (E) Rare, 1994 ft. MIXED; ROAD; *DG398.*

Typhaceae

Typha domingensis Pers. – Southern Cattail. (N) (PH) Rare, 2050 ft. AL; WET; *DG221.*

Abbreviations. The following abbreviations were used in annotating the catalog of vascular plants in the Lime Creek area:

Collectors and herbaria where their specimens are deposited – Adams, Karen (ARIZ) = KRA; Anderson, John (ASU) = JLA; Damrel, Dixie with the Terrestrial Ecological Unit Inventory team (TEUI) = DZD; Doan, Shannon (ASU) = SD; Goldman, Dawn with Joni Ward (DES) = DG; Hodgson, Wendy (DES) = WCH; Spellenberg, Richard (ARIZ) = RS; Welch, John (ARIZ) = JW.

Habitat descriptions – Hills and Slopes = HILL; Ridges = RIDGE; Roads and Trails = ROAD; Rocks = ROCK; Dry Washes = WASH; Wetlands including Lime Creek its borders and the spring = WET.

Life form descriptions – Ephemerals = (E); Leaf Succulents = (LS); Parasites = (P); Perennial Herbs = (PH); Shrubs = (S); Stem Succulents = (SS); Trees = (T); Vines = (V).

Plant status– Introduced = (I); Native = (N).

Soil type descriptions – Alluvial = AL; In all soil types = ALL; Limestone Lacustrian Unit = LLU; Limestone Lacustrian Unit and Basalt = MIXED.

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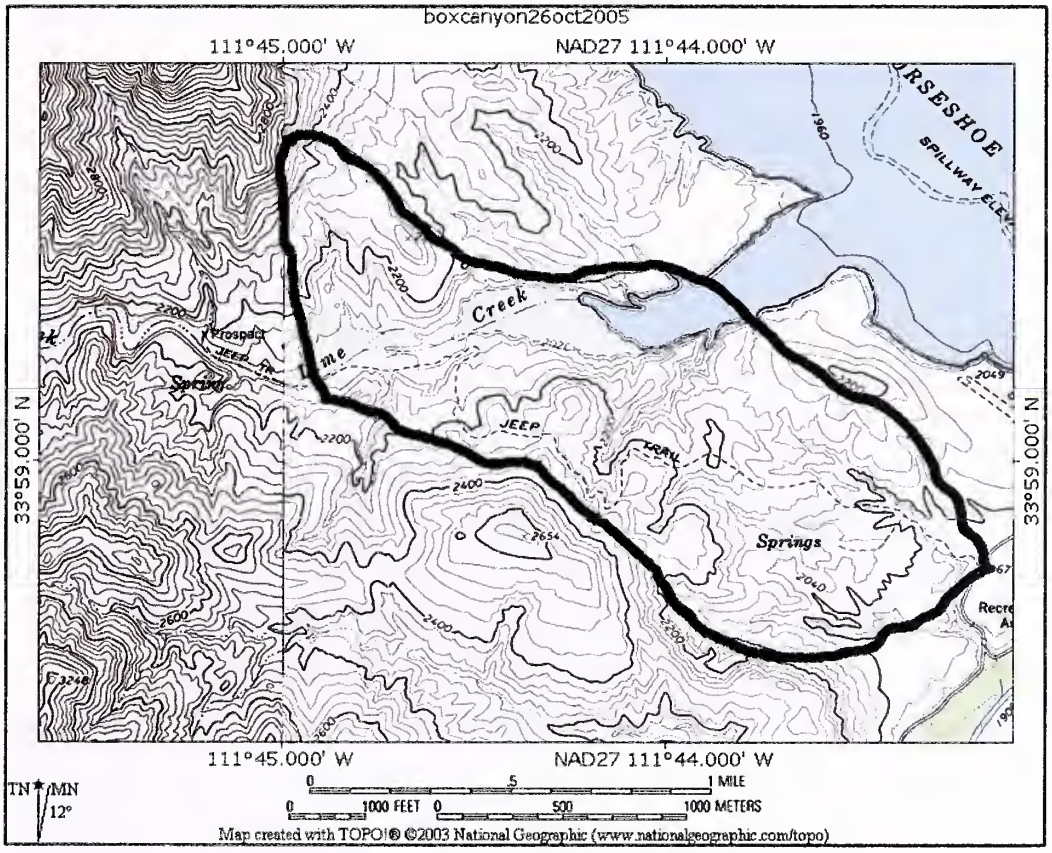
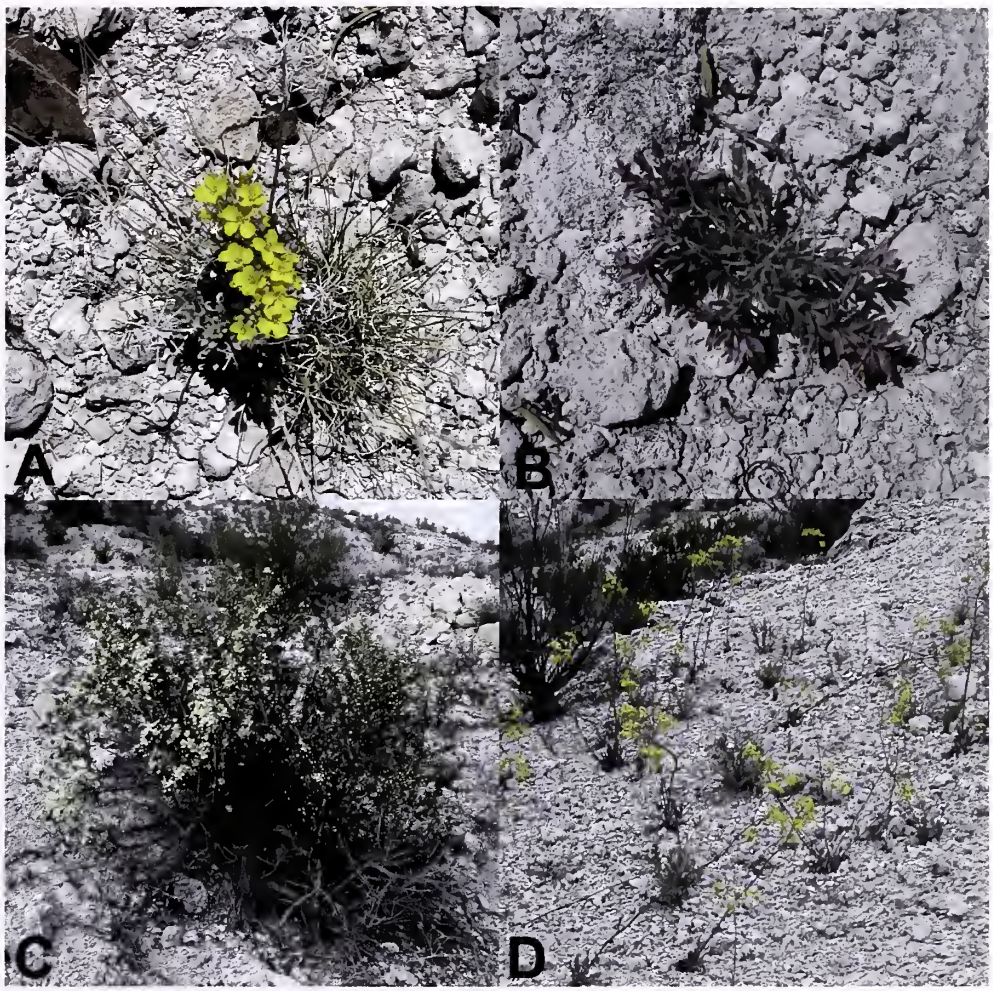


Lime Creek Flora Figure 1. Map of Lime Creek Site (LCSS) showing survey boundaries, Maricopa County, Arizona.

Lime Creek Flora Figure 2. (A) Rolling hillsides with lacustrine soils and sparse vegetation are very common throughout the study area; (B) Floral display including *Phlox tenuifolia, Castilleja lanata*, and *Eriogonum fasciculatum* var. *polifolium* found in one of the areas with mixed soil types.



Lime Creek Flora Figure 3. (A) Bladderpod (*Lesquerella cinerea*), normally found at higher elevations, is seen in abundance on the lacustrine hillsides; (B) *Polygala rusbyi*, a disjunct from the Mohave Desert, has larger flowers than any other Arizona *Polygala*; (C) The only endangered species found in the flora area, *Purshia* ×*subintegra*, appears to thrive in this environment; (D) *Packera neomexicana*, another disjunct, is scattered on this east-facing lacustrine hillside after the winter rains of 2005.

A REVISED CATALOG OF ARIZONA LICHENS

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ABSTRACT

This revised "catalog" of lichens includes 969 species of lichenized fungi (lichens) presented for the state of Arizona (USA), and updates the original catalog published in 1975 by Nash and Johnsen. These taxa are derived from within 5 classes and over 17 orders and 54 families (the latter two with 3 and 4 additional groups of uncertain taxonomic position, "*Incertae sedis*") in the phylum *Ascomycota*. The total number of species reported here represents approximately 20% of all species known from the North American lichen flora. The list was compiled by extracting Arizona records from the three volume published set of the *Lichen Flora of the Greater Sonoran Desert Region*, a collaborative, authoritative treatment of lichen groups for this region that encompasses the entire state of Arizona.

INTRODUCTION

Nearly 80,000 species of fungi are known to science (Schmit and Mueller 2007). Of these, approximately 17% are lichenized, forming symbioses with green algae (*Chlorophyta, Viridiplantae*) or the so called blue-green algae (*Cyanobacteria, Bacteria*). These relationships produce symbiotic organisms commonly called lichens. The fungal partner (mycobiont) is thought to benefit by having access to photosynthates produced by the "algae" (photobiont), which, within the symbiosis, is thought to receive some form of protection (e.g., against desiccation or UV radiation); however, evidence for other interpretations (e.g., controlled parasitism) exist (see Nash 2008a). The perception of lichens as classic dual mutualistic symbionts is, perhaps, rather simplistic as a single lichen thallus may host complex communities of microbes, including lichenicolous (lichen-associated) or endolichenic (growing within the cells of the lichen mycobiont) fungi, both types of photobionts (tripartite lichens), and even non-photosynthetic bacteria (Lawrey & Diederich 2003, Diederich 2004, Suryanarayanan et al. 2005, Nash 2008a, Arnold et al. 2009, Grube et al. 2009, Hodkinson & Lutzoni 2009).

Despite this potential for lichens to act as multifaceted symbiotic systems, their taxonomy rests solely on the mycobiont, as lichen species names refer only to

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the lichenized fungus. A full 98% of all lichen-forming fungi can be found within the phylum *Ascomycota*, although some are members of the *Basidiomycota* (e.g., *Lichenomphalia* spp.), and approximately 42% of all known ascomycetous fungi are lichenized, compared to only 0.3% for basidiomycetes (Honegger 2008). In total, lichen-forming fungi are found within 5 classes of the *Ascomycota*, the majority of species being found within the *Lecanorales* (*Lecanoromycetes*), and within 1 class (*Agaricomycetes*) of the *Basidiomycota* (Honegger 2008). In addition, a rather interesting borderline case of "lichenization" is the fungus *Geosiphon pyriforme*, which unlike "true" lichens does not have extracellular photobionts surrounded by hyphae. Instead, this species has an intracellular (e.g., contained within the hyphae) endosymbiotic cyanobacterium (*Nostoc*). Being found within the *Glomeromycota*, *G. pyriforme* is more closely related to arbuscular mycorrhizal fungi than all other lichen species (Gehrig et al. 1996).

In addition to their rich phylogenetic diversity, lichens also display a wonderful diversity of colors, which are the byproduct of the numerous secondary metabolites (*ca.* 700 organic compounds are known, with over 90% being specifically produced by lichens; Elix & Stocker-Wörgötter 2008), and growth forms (see Fig. 1A–I). For the latter, three principal growth forms are traditionally recognized: crustose (e.g., Fig. 1G), foliose (e.g., Fig. 1D), and fruticose (e.g., 1E). Representing the most rudimentary thallus structure, the crustose (crust-like) lichen has only an upper cortex, while the lower surface adheres to the substrate on which the lichen is growing. This type of thallus is desiccation resistant and less susceptible to disturbance (e.g., storms, wind, etc.), and as a result it is often able to survive under extreme conditions (e.g., at high altitude on rock surfaces) where other growth forms are not able to exist. In addition to this adaptive resilience, crustose lichens are able to thrive under a wide range of environmental conditions, and as a result are broadly distributed: from leaf surfaces in the tropics, to rock and wood surfaces in temperate areas, and even on desert soils. Foliose (leaf-like) lichens typically have upper and lower cortices and are more loosely attached to their substrate. This type of growth form is well represented and often quite conspicuous in more moderate climates, growing on rock, tree bark, or over soils. One interesting variation of this growth form, the vagrant lichen (Fig. 1B), does not attach to a substrate, and is found over soils, being blown about freely by wind. Fruticose lichens represent the most dimensional lichen growth form, having beard-, hair-, shrub-, and strap-like forms, and their thalli typically have a radial arrangement (a single, fairly uniform cortex surrounding a central axis). There is quite a bit of variation to the fruticose lichen thallus, ranging from a single stem-like appendage which elevates the apothecium (e.g., the podetium of *Cladonia* spp.), to highly-branched (e.g., *Usnea intermedia*; Fig. 1E) or long pendulous (e.g., *Usnea longissima*) forms. The fruticose growth form is preferentially distributed in temperate rain forests or dry areas where precipitation is infrequent but fog or dew events are regular (e.g., along arid coastal zones; Büdel & Scheidegger 2008).

Lichens are an important, but sometimes overlooked, part of the ecosystems in which they are found: as components in nutrient and mineral cycling; contributors to pedogensis; providers of food, shelter, and nest building material for micro- and mega-fauna; and they can serve as bioindicators of ecosystem health or air quality

(reviewed in Nash 2008a). For example, lichens (particularly those with cyanobacterial photobionts that can fix atmospheric nitrogen) contribute, sometimes significantly, to total N inputs in many ecosystems (Nash 2008b). These numerous ecological roles are, perhaps, more fully appreciated in light of the fact that lichens are poikilohydric (their water status is passively dependent on environmental conditions) and that they also rely, almost entirely, on atmospheric deposition in order to obtain macro- and micro-nutrients required for life (see Nash 2008a).

The history of lichenology in Arizona is fairly extensive, dating back to the late seventeenth and early eighteenth centuries, with some of more prominent lichenologists of that time period citing records of lichens from Arizona or describing new species from specimens collected in the state. For example in the late 1800s, Edward Tuckerman, the pioneering American lichenologist, and Henry Willey described *Omphalodium hottentottum* var. *arizonicum* Tuck. ex Willey [= *Omphalora arizonica* (Tuck. ex Willey) T.H. Nash & Hafellner] based on a specimen collected in the Santa Rita Mountains (Willey 1881). The distinguished Austrian lichenologist Alexander Zahlbruckner (1908) published 6 new lichen species (and one novel variety) based on collections from the Carnegie Desert Botanical Laboratory near Tucson. The following year Bruce Fink (1909), another leading American lichenologist of this period and author of the *Lichen Flora of the United States*, noted additional species occurring in this same area and reported 33 species from the "desert lichen flora". Additional like examples can be found in Nash and Johnsen (1975); however, it was not until the mid-1990s that lichen floras which focused on specific regions in the state were published (Darrow 1950, Weber 1963, Johnsen 1965).

Focus on the Arizona lichen flora intensified in the latter-half of the 1900s. In 1971, the Arizona State University Herbarium (ASU) began to expand its collection of lichens under the directorship of T.H. Nash III (from an original *ca.* 100 specimens, the majority being from Sweden, to the nearly 110,000 specimens today, approximately 50,000 attributed to Nash, originating from countries around the globe but focusing primarily on the greater Sonoran Desert region, and including Arizona), that eventually required these specimens to be housed separately from the vascular plant collection. Nash (1973b) began reporting records for the Arizona lichen flora and publishing on new species from the state (e.g., Nash 1973a). In the mid-1980s, the late Bruce D. Ryan enrolled in the graduate program at Arizona State University and received his doctorate degree in 1989, focusing on *Lecanora* subgen. *Placodium* for his dissertation. Ryan later served as the Lichen Herbarium Associate Curator (from 1989–2004), and amassed *ca.* 20,000 personal collections, deposited at ASU, many of which are from Arizona. The effort to increase knowledge of the Arizona lichen flora and to collect more extensively in the state continued on into the 20th century and resulted in publication of several regional floras for the state (Nash 1975, Nash 1977, Nash & Sigal 1981, Nash 1991, Boykin & Nash 1994, Sweat et al., 2004, Jackson et al. 2005), the original catalog of Arizona lichens (Nash & Johnsen 1975), consecutive additions to the flora (Moberg and Weber 1974, Nash 1985, Nash et al. 1998), as well as a field guide to epiphytic macrolichens from the state (Bungartz et al. 2002).

Nash and Ryan's combined and comprehensive knowledge of the area's lichen flora, the popular lichen keys produced by Dr. Ryan, the growing body of literature, and a fruitful collecting trip with the International Association of Lichenologists (IAL) in 1989 to the Sonoran Desert, which piqued the interest of several European lichen taxonomists, provided the foundation, network, and synergy for what eventually became a National Science Foundation funded project, the *Greater Sonoran Desert Lichen Flora.* This floristic effort, which included 92 collaborators from 23 countries coordinated by Nash, culminated with the publication of a three volume monograph (Nash et al. 2002, 2004, 2007) that provided keys, authoritative taxonomic treatments, as well as a thorough introduction to the science of lichenology. These volumes not only profoundly increased the understanding of the lichen floras of the Sonoran Desert and surrounding environs (e.g., southern California) as well as Arizona, but they expanded the taxonomic knowledge of the North American lichen flora in general and made a considerable contribution to lichenology in Mexico.

METHODS

The compilation of this lichen "catalog" follows the methods outlined previously in the checklists of Arizona macrofungi and slime molds (Bates 2006, Bates & Barber 2008), with one notable exception: the records published here are referenced almost exclusively to the *Lichen Flora of the Greater Sonoran Desert Region* (Nash et al. 2002, 2004, 2007) as it represents the authoritative account of Arizona lichens. Reference specimens for the lichen flora of the state are housed in the Arizona State University Lichen Herbarium (ASU), which represents one of the more significant lichen collections (including important historical components; see e.g., Nash 2002) in North America, if not the world, and is irreplaceable in its value as a living regional collection. Synonymy and currently accepted names follow the *Cumulative Checklist for the Lichen-Forming, Lichenicolous and Allied Fungi of the Continental United States and Canada* (Esslinger 2010), and the classification system used conforms to the CABI *Index Fungorum* (http://www.indexfungorum.org).

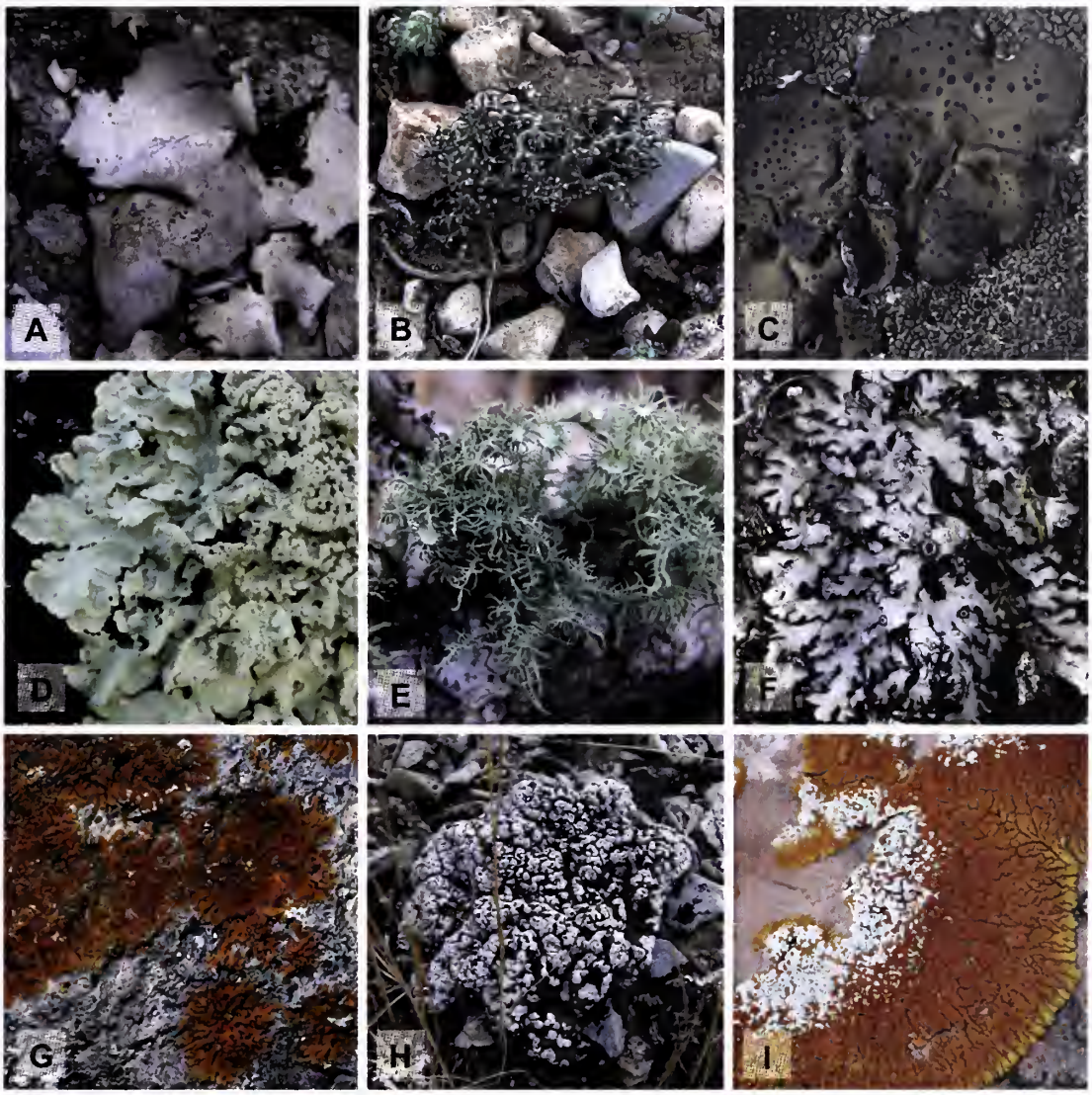
As with previous Arizona checklists (Bates 2006, Bates & Barber 2008), the data from this publication are available online (http://www.azfungi.org/checklist/), now as the *Checklist of Arizona Macrofungi, Lichens, and Slime Molds*, which includes approximately 7000 records of lichenized and non-lichenized fungi (and slime molds) from the state. In addition, many species in the online checklist are linked to images, which were generated primarily through the *Arizona Mycota Project* (www.azfungi.org/amp/). Perhaps more importantly, these data as well as those related to the *Lichen Flora of the Greater Sonoran Desert Region* and the ASU Lichen Herbarium are now accessible online in conjunction with data from several other lichen herbaria on the Symbiota (http://www.symbiota.org) lichen node, *Consortium of North American Lichen Herbaria* (CNALH; http://symbiota.org/nalichens/). Those data, representing a comprehensive coverage of North American lichens, are presented as a searchable database and as dynamic checklists (e.g., United States and Canada, Mexico, numerous U.S. National Parks,

as well as Arizona and specific regions within the state; http://symbiota.org/nalichens/checklists/) generated from the available herbaria records in real-time. Each checklist is also presented as a "user-friendly", interactive symbiota keying system (http://symbiota.org/nalichens/ident/), which lead the user through a series of progressive, multiple character decisions (based on a hierarchical ranking of character importance relevant to differing taxonomic levels). In addition, a large image database is also linked with species presented on the CNALH website, which include digitized photographs of herbarium specimens (including types) as well as from the field (including the extensive collection of Stephen Sharnoff; see Brodo et al. 2001).

RESULTS, DISCUSSION, AND CONCLUSIONS

Records for nine hundred sixty-nine species of lichenized fungi (and 13 additional varieties or subspecies) from 54 families (and 3 additional groups of uncertain taxonomic position), 17 orders (and 4 additional groups of uncertain taxonomic position), and 5 classes (all of the classes known to contain lichen-forming fungi), within the *Ascomycota*, are reported here. By far, the *Lecanoromycetes* represents the single largest group (~84% of all lichen species in the flora) of lichens at the class level, and this class also includes the most species-rich lichen families; the *Parmeliaceae* (~15% of all lichen species), the *Lecanoraceae* (~11% of all lichen species), and the *Physciaceae* (at 7.9% of all lichen species). Interestingly, the second largest class level group (*Eurotiomycetes*) represents only about 9% of all lichen species in the flora, yet it contains the fourth most species-rich lichen family (*Verrucariaceae* at 7.7% of all lichen species). When parsed by growth forms, crustose lichens (including subgroups such as endolithic, peltate, placodioid, and squamulose lichens) comprise the largest group, representing approximately 60% of all lichens in the flora, followed by foliose lichens (~30%), and then fruticose lichens (~10%). Two additional growth forms, leprose and calicioid, each account for roughly 1% of the flora.

Arizona has an exceptional variety of biomes which has resulted in an extensive diversity of macrofungi (see Bates 2006); likewise, the diversity of lichens present in the state is also considerably rich; representing approximately half of species recorded for the *Lichen Flora of the Greater Sonoran Desert Region* and nearly 20% of the known lichen flora of North America. The list of Arizona lichen species included here is noticeably larger, over a two-fold increase, than that presented in the original catalog (Nash and Johnsen 1975). This increased understanding of the Arizona lichen flora is the product of the tremendous effort and rigorous scientific study that was inherit in monographing the flora of the Greater Sonoran Desert Region, which resulted in the publication of over 400 taxa new to science and included the discovery of 2 novel genera (see the preface of Nash et al. 2007). These figures highlight the value of concentrated and continued work in monography as well as alpha-taxonomy, and point to the fact that, even for a "well studied" area such as the United States, a comprehensive understanding of the Earth's fungal biota (for both lichenized and non-lichenized groups) is far from being achieved.



Arizona Lichens Figure 1. Diversity of growth forms of lichenized fungi (lichens). (A) *Umbilicaria americana* (foliose/umbilicate, on rock); (B) *Aspicilia hispida* (fruticose, vagrant over soil); (C) *Umbilicaria phaea* (foliose/umbilicate, on rock); (D) *Flavoparmelia baltimorensis* (foliose, on rock); (E) *Usnea intermedia* (fruticose, on bark); (F) *Phaeophyscia hispidula* (small-foliose, on rock); (G) *Caloplaca brouardii* (crustose, on rock); (H) *Psora cerebriformis* (crustose/squamulose, on soil); (I) *Acarospora stapfiana* (crustose, parasitic on *Caloplaca* sp.) – (Photos C, F, G by F. Bungartz; A, B, D, E, H by S.T. Bates; I by J. Siminitus).

A REVISED CATALOG OF ARIZONA LICHENS

□ **FUNGI**
• **ASCOMYCOTA**
† **ARTHONIOMYCETES**
ARTHONIOMYCETIDAE
ARTHONIALES

Arthoniaceae
Arthonia patellulata Nyl. [3]

Chrysothricaceae
Chrysothrix candelaris (L.) J.R. Laundon [2]

† **DOTHIDEOMYCETES**
DOTHIDEOMYCETIDAE
INCERTAE SEDIS

Mycoporaceae
Mycoporum antecellens (Nyl.) R.C. Harris [1]*

INCERTAE SEDIS
INCERTAE SEDIS

Protothelenellaceae
Protothelenella sphinctrinoidella (Nyl.) H. Mayrhofer & Poelt [1]
Thelenellaceae
Thelenella inductula (Nyl.) H. Mayrhofer [1]
Thelenella muscorum (Fr.) Vain. var. *muscorum* [1]*

PLEOSPOROMYCETIDAE
PLEOSPORALES

Arthopyreniaceae
Arthopyrenia punctiformis (Schrank) A. Massal. [1]
Arthopyrenia rhyponta (Ach.) A. Massal. [1]
Leptorhaphis atomaria (Ach.) Szatala [1]

† **EUROTIOMYCETES**
CHAETOTHYRIOMYCETIDAE
PYRENULALES

Monoblastiaceae
Anisomeridium biforme (Borrer) R.C. Harris [1]

VERRUCARIALES

Incertae sedis
Agonimia tristicula (Nyl.) Zahlbr. [1]
Staurothele areolata (Ach.) Lettau [1]
Staurothele clopimoides (Bagl. & Carestia) J. Steiner [1]
Staurothele drummondii (Tuck.) Tuck. [1]
Staurothele effigurata J.W. Thomson [1]
Staurothele elenkinii Oxner [1]
Staurothele lecideoides B. de Lesd. [1]
Staurothele monicae (Zahlbr.) Wetmore [1]
Staurothele polygonia B. de Lesd. [1]
Staurothele verruculosa J.W. Thomson [1]

Verrucariaceae
Baglietoa baldensis (A. Massal.) Vězda [3]
Baglietoa calciseda (DC.) Gueidan & Cl. Roux [3]*
Catapyrenium psoromoides (Borrer) R. Sant. [1]
Catapyrenium squamellum (Nyl.) J.W. Thomson [1]
Dermatocarpon americanum Vain. [2]
Dermatocarpon bachmannii Anders [2]
Dermatocarpon leptophyllodes (Nyl.) Zahlbr. [2]
Dermatocarpon luridum (With.) J.R. Laundon [2]
Dermatocarpon moulinsii (Mont.) Zahlbr. [2]
Dermatocarpon polyphyllizum (Nyl.) Blomb. & Forssell [2]
Dermatocarpon reticulatum H. Magn. [2]
Dermatocarpon schaechtelinii Werner [2]
Dermatocarpon taniinium Heiðm. [2]
Dermatocarpon tenue (Müll. Arg.) Heiðm. [2]
Digitothyrea polyglossa (Nyl.) P.P. Moreno & Egea [1]
Endocarpon loscosii Müll. Arg. [1]
Endocarpon pallidulum (Nyl.) Nyl. [1]
Endocarpon petrolepideum (Nyl.) Nyl. [1]
Endocarpon pusillum Hedw. [1]
Endocarpon schisticola (B. de Lesd.) Servít [1]
Normandina pulchella (Borrer) Nyl. [2]
Placidium acarosporoides (Zahlbr.) Breuss [1]
Placidium andicola (Breuss) Breuss [1]
Placidium arboreum (Schwein. ex E. Michener) Lendemer [1]*
Placidium chilense (Räsänen) Breuss [1]
Placidium fingens (Breuss) Breuss [1]
Placidium lachneum (Ach.) B. de Lesd. [1]
Placidium lacinulatum var. *atrans* Breuss [1]
Placidium lacinulatum var. *erythrostratum* Breuss [1]
Placidium lacinulatum (Ach.) Breuss var. *lacinulatum* [1]
Placidium michelii A. Massal. [1]
Placidium pilosellum (Breuss) Breuss [1]
Placidium rufescens (Ach.) A. Massal. [1]
Placidium squamulosum (Ach.) Breuss [1]
Placidium umbrinum (Breuss) M. Prieto & Breuss [1]*
Placopyrenium caeruleopulvinum (J.W. Thomson) Breuss [1]
Placopyrenium lecideoides (A. Massal.) Gueidan & Cl. Roux [3]*
Placopyrenium stanfordii (Herre) K. Knudsen [1]*
Verrucaria alutacea Wallr. [3]
Verrucaria americana (B. de Lesd.) Breuss [3]
Verrucaria amylacea Hepp [3]
Verrucaria beltraminiana (A. Massal.) Trevis. [3]
Verrucaria bernaicensis Malbr. [3]
Verrucaria bernardinensis Breuss [3]
Verrucaria calkinsiana Servít [3]
Verrucaria cetera Breuss [3]
Verrucaria compacta (A. Massal.) Jatta [3]
Verrucaria confluens A. Massal. [3]
Verrucaria dolosa Hepp [3]
Verrucaria elaeina Borrer [3]
Verrucaria endocarpoides Servít [3]
Verrucaria falcata Breuss [3]
Verrucaria funckii (Spreng.) Zahlbr. [3]
Verrucaria furfuracea (B. de Lesd.) Breuss [3]
Verrucaria fusca Pers. [3]
Verrucaria fuscoatroides Servít [3]
Verrucaria glaucovirens Grummann [3]
Verrucaria hydrela Ach. [3]
Verrucaria incrassata Breuss [3]
Verrucaria inficiens Breuss [3]
Verrucaria inornata Servít [3]
Verrucaria macrostoma Dufour ex DC. [3]
Verrucaria maculicarpa Breuss [3]
Verrucaria margacea (Wahlenb.) Wahlenb. [3]
Verrucaria minor Breuss [3]
Verrucaria muralis Ach. [3]
Verrucaria murorum (Arnold) Lindau [3]
Verrucaria nigrescens Pers. [3]
Verrucaria nigrofusca Servít [3]
Verrucaria onegensis Vain. [3]
Verrucaria papillosa Ach. [3]
Verrucaria prosoplectenchymatica Servít [3]

Verrucaria quercina Breuss [3]
Verrucaria rubrocincta Breuss [3]
Verrucaria rupicola (B. de Lesd.) Breuss [3]
Verrucaria schindleri Servít [3]
Verrucaria sphaerospora Anzi [3]
Verrucaria trabicola Arnold [3]
Verrucaria viridula (Schrad.) Ach. [3]

† LECANOROMYCETES
ACAROSPOROMYCETIDAE
ACAROSPORALES

Acarosporaceae
Acarospora affinis K. Knudsen [3]
Acarospora badiofusca (Nyl.) Th. Fr. [3]
Acarospora brouardii B. de Lesd. [3]
Acarospora calcarea K. Knudsen [3]
Acarospora chrysops (Tuck.) H. Magn. [3]
Acarospora contigua H. Magn. [3]
Acarospora dispersa H. Magn. [3]
Acarospora erythrophora H. Magn. [3]
Acarospora fuscata (Nyl.) Arnold [3]
Acarospora glaucocarpa (Ach.) Körb. [3]
Acarospora heufleriana Körb. [3]
Acarospora interspersa H. Magn. [3]
Acarospora macrospora (Hepp) A. Massal. ex Bagl. [3]
Acarospora nevadensis H. Magn. [3]
Acarospora nodulosa (Dufour) Hue [3]
Acaospora novomexicana H. Magn. [3]
Acarospora obnubila H. Magn. [3]
Acarospora obpallens (Nyl.) Zahlbr. [3]
Acarospora oligospora (Nyl.) Arnold [3]
Acarospora peliocypha (Wahlenb.) Th. Fr. [3]
Acarospora rhabarbarina Hue [3]
Acarospora rouxii K. Knudsen, Elix & Reeb [3]
Acarospora rosulata (Th. Fr.) H. Magn. [3]*
Acarospora scabrida Hedl. ex H. Magn. [3]
Acarospora schleicheri (Ach.) A. Massal. [3]
Acarospora scotica Hue [3]
Acarospora socialis H. Magn. [3]
Acarospora stapfiana (Müll. Arg.) Hue [3]
Acarospora strigata (Nyl.) Jatta [3]
Acarospora thamnina (Tuck.) Herre [3]
Acarospora tuckerae K. Knudsen [3]
Acarospora veronensis A. Massal. [3]
Glypholecia scabra (Pers.) Müll. Arg. [1]
Pleopsidium flavum (Bellardi) Körb. [3]
Polysporina gyrocarpa (H. Magn.) N.S. Golubk. [3]*
Polysporina simplex (Davies) Vězda [3]
Polysporina subfuscescens (Nyl.) K. Knudsen & Kocourk. [3]*
Polysporina urceolata (Anzi) Brodo [3]
Sarcogyne clavus (DC.) Kremp. [3]
Sarcogyne dakotensis H. Magn. [3]
Sarcogyne desolata (H. Magn.) K. Knudsen & S. Standl. [3]
Sarcogyne privigna (Ach.) A. Massal. [3]
Sarcogyne regularis Körb. [3]
Sarcogyne similis H. Magn. [3]

INCERTAE SEDIS
CANDELARIALES

Candelariaceae
Candelaria concolor (Dicks.) Stein [1]
Candelaria fibrosa (Fr.) Müll. Arg. [1]
Candelaria pacifica M. Westb. & Arup [4]
Candelariella antennaria Räsänen [2]
Candelariella aurella (Hoffm.) Zahlbr. [2]
Candelariella citrina B. de Lesd. [2]
Candelariella complanata M. Westb. [2]
Candelariella deppeanae M. Westb. [2]
Candelariella efflorescens R.C. Harris & W.R. Buck [2]
Candelariella kansuensis H. Magn. [3]
Candelariella lutella (Vain.) Räsänen [2]
Candelariella rosulans (Müll. Arg.) Zahlbr. [2]
Candelariella subdeflexa (Nyl.) Lettau [2]
Candelariella vitellina (Hoffm.) Müll. Arg. [2]
Candelariella xanthostigma (Ach.) Lettau [2]
Candelina mexicana (de Lesd.) Poelt [1]
Candelina submexicana (de Lesd.) Poelt [1]
Placomaronea mendozae (Räsänen) M. Westb. [2]

INCERTAE SEDIS

Incertae sedis
Pycnora praestabilis (Nyl.) Hafellner [1]
Pycnora sorophora (Vain.) Hafellner [1]

UMBILICARIALES

Ophioparmaceae
Hypocenomyce anthracophila (Nyl.) P. James & Gotth. Schneid. [1]
Hypocenomyce castaneocinerea (Räsänen) Timdal [1]
Hypocenomyce friesii (Ach.) P. James & Gotth. Schneid. [1]
Hypocenomyce oligospora Timdal [1]
Hypocenomyce scalaris (Ach. ex Lilj.) M. Choisy [1]
Hypocenomyce sierrae Timdal [1]

Umbilicariaceae
Lasallia papulosa (Ach.) Llano [2]
Lasallia pennsylvanica (Ach.) Llano [2]
Umbilicaria americana Poelt & T.H. Nash [2]
Umbilicaria cinereorufescens (Schaer.) Frey [2]
Umbilicaria cylindrica (L.) Delise ex Duby [2]
Umbilicaria decussata (Vill.) Zahlbr. [2]
Umbilicaria deusta (L.) Baumg. [2]
Umbilicaria hyperborea (Ach.) Hoffm. [2]
Umbilicaria krascheninnikovii (Savicz) Zahlbr. [2]
Umbilicaria muehlenbergii (Ach.) Tuck. [2]
Umbilicaria nylanderiana (Zahlbr.) H. Magn. [2]
Umbilicaria phaea Tuck. [2]
Umbilicaria polyphylla (L.) Baumg. [2]
Umbilicaria subglabra (Nyl.) Harm. [2]
Umbilicaria torrefacta (Lightf.) Schrad. [2]
Umbilicaria vellea (L.) Ach. [2]
Umbilicaria virginis Schrad. [2]

LECANOROMYCETIDAE
INCERTAE SEDIS

Coniocybaceae
Chaenotheca chrysocephala (Turner ex Ach.) Th. Fr. [2]
Chaenotheca furfuracea (L.) Tibell [2]

LECANORALES

Aphanopsidaceae
Steinia geophana (Nyl.) Stein [2]

Biatorellaceae
Piccolia ochrophora (Nyl.) Hafellner [3]*

Cladoniaceae
Cladonia acuminata (Ach.) Norrl. [1]
Cladonia bacilliformis (Nyl.) Glück [1]
Cladonia borealis S. Stenroos [1]

Cladonia cariosa (Ach.) Spreng. [1]
Cladonia carneola (Fr.) Fr. [1]
Cladonia cenotea (Ach.) Schaer. [1]
Cladonia cervicornis (Ach.) Flot. subsp. *cervicornis* [1]
Cladonia chlorophaea (Flörke ex Sommerf.) Spreng. [1]
Cladonia coniocraea (Flörke) Spreng. [1]
Cladonia deformis (L.) Hoffm. [1]
Cladonia fimbriata (L.) Fr. [1]
Cladonia furcata (Huds.) Schrad. [1]
Cladonia gracilis (Ach.) Ahti subsp. *turbinata* [1]
Cladonia humilis (With.) J.R. Laundon [1]
Cladonia jaliscana Ahti & Guzm.-Dáv. [1]
Cladonia macilenta Hoffm. [1]
Cladonia macrophyllodes Nyl. [1]
Cladonia multiformis G. Merr. [1]
Cladonia ochrochlora Flörke [1]
Cladonia parasitica (Hoffm.) Hoffm. [1]
Cladonia pleurota (Flörke) Schaer. [1]
Cladonia pocillum (Ach.) O.J. Rich. [1]
Cladonia pulvinella S. Hammer [1]
Cladonia pyxidata (L.) Hoffm. [1]
Cladonia subfimbriata Ahti [1]
Cladonia subradiata (Vain.) Sandst. [1]
Cladonia subulata (L.) Weber ex F.H. Wigg. [1]
Cladonia sulphurina (Michx.) Fr. [1]
Cladonia symphycarpa (Flörke) Fr. [1]

Gypsoplacaceae
Gypsoplaca macrophylla (Zahlbr.) Timdal [3]

Haematommataceae
Haematomma fenzlianum A. Massal. [2]

Incertae sedis
Botryolepraria lesdainii (Hue) Canals, Hern.-Mar., Gómez-Bolea & Llimona [3]
Lecania arizonica B.D. Ryan & van den Boom [2]
Lecania coeruleorubella (Mudd) M. Mayrhofer [2]
Lecania polycycla (Anzi) Lettau [2]
Leprocaulon albicans Nyl. [1]
Leprocaulon gracilescens (Nyl.) I.M. Lamb & A.M. Ward [1]
Leprocaulon microscopicum (Vill.) Gams ex D. Hawksw. [1]
Myxobilimbia sabuletorum (Schreb.) Hafellner [2]
Psilolechia lucida (Ach.) M. Choisy [3]
Scoliciosporum intrusum (Th. Fr.) Hafellner [2]*
Scoliciosporum umbrinum (Ach.) Arnold [2]
Tremolecia atrata (Ach.) Hertel [2]
Vahliella californica (Tuck.) P.M. Jørg. [1]*
Vahliella hookerioides (P.M. Jørg.) P.M. Jørg. [1]*
Vahliella leucophaea (Vahl) P.M. Jørg. [1]*

Lecanoraceae
Carbonea latypizodes (Nyl.) Knoph & Rambold [2]
Carbonea vorticosa (Flörke) Hertel [2]
Clauzadeana macula (Taylor) Coppins & Rambold [2]
Lecanora albella (Pers.) Ach. [2]
Lecanora albellula (Nyl.) Th. Fr. [2]
Lecanora allophana (Ach.) Nyl. [2]
Lecanora arenisaxicola B.D. Ryan & T.H. Nash [2]
Lecanora argentata (Ach.) Malme [2]
Lecanora argentea Oxner & Volkova [2]
Lecanora argopholis (Ach.) Ach. [2]
Lecanora bicincta Ramond [2]
Lecanora bipruinosa Fink ex J. Hedrick [2]
Lecanora boligera (Th. Fr.) Hedl. [2]
Lecanora brodoana Lumbsch & T.H. Nash [2]
Lecanora cadubriae (A. Massal.) Hedl. [2]
Lecanora caesiorubella Ach. [2]
Lecanora campestris (Schaer.) Hue [2]
Lecanora carpinea (L.) Vain. [2]
Lecanora cavicola Creveld [2]
Lecanora cenisia Ach. [2]
Lecanora chlarotera Nyl. [2]
Lecanora circumborealis Brodo & Vitik. [2]
Lecanora comoduensis T.H. Nash & Hertel [2]
Lecanora coniferarum Printzen [2]
Lecanora crenulata (Dicks.) Hook. [2]
Lecanora densa (Śliwa & Wetmore) Printzen [2]
Lecanora dispersa (Pers.) Röhl. [2]
Lecanora flowersiana H. Magn. [2]
Lecanora gangaleoides Nyl. [2]
Lecanora garovaglioi subsp. *cascadensis* (H. Magn.) B.D. Ryan & T.H. Nash [2]
Lecanora garovaglioi (Körb.) Zahlbr. subsp. *garovaglioi* [2]
Lecanora geiserae B.D. Ryan [2]
Lecanora hagenii (Ach.) Ach. [2]
Lecanora horiza (Ach.) Linds. [2]
Lecanora hybocarpa (Tuck.) Brodo [2]
Lecanora aff. *hypoptoides* (Nyl.) Nyl. [2]
Lecanora impudens Degel. [2]
Lecanora intricata (Ach.) Ach. [2]
Lecanora juniperina Śliwa [2]
Lecanora kofae B.D. Ryan & T.H. Nash [2]
Lecanora laatokkensis (Räsänen) Poelt [2]
Lecanora marginata (Schaer.) Hertel & Rambold [2]
Lecanora mazatzalensis B.D. Ryan & T.H. Nash [2]
Lecanora melaena (Hedl.) Fink [2]
Lecanora meridionalis H. Magn. [2]
Lecanora mughicola Nyl. [2]
Lecanora muralis var. *brunneola* (Mereschk.) B.D. Ryan & T.H. Nash [2]
Lecanora muralis (Schreb.) Rabenh. var. *muralis* [2]
Lecanora nashii B.D. Ryan [2]
Lecanora neodegelii B.D. Ryan & T.H. Nash [2]
Lecanora novomexicana H. Magn. [2]
Lecanora opiniconensis Brodo [2]
Lecanora oreinoides (Körb.) Hertel & Rambold [2]
Lecanora orizabana Vain. [2]
Lecanora pacifica Tuck. [2]
Lecanora peltastictoides Hasse [2]*
Lecanora phaedrophthalma var. *christoi* (W.A. Weber) B.D. Ryan [2]
Lecanora phaedrophthalma Poelt var. *phaedrophthalma* [2]
Lecanora plumosa Müll. Arg. [2]
Lecanora polytropa (Ehrh.) Rabenh. [2]
Lecanora pringlei subsp. *brandegei* (Tuck.) B.D. Ryan [2]
Lecanora pseudistera Nyl. [2]
Lecanora pulicaris (Pers.) Ach. [2]
Lecanora rupicola (L.) Zahlbr. [2]
Lecanora saligna (Schrad.) Zahlbr. [2]
Lecanora semipallida H. Magn. [2]*
Lecanora subcavicola B.D. Ryan [2]
Lecanora subimmergens Vain. [2]
Lecanora subintricata (Nyl.) Th. Fr. [2]
Lecanora subrugosa Nyl. [2]
Lecanora swartzii (Ach.) Ach. [2]
Lecanora symmicta (Ach.) Ach. [2]
Lecanora thallophila H. Magn. [2]
Lecanora umbrosa Degel. [2]
Lecanora valesiaca var. *sibirica* Poelt [2]
Lecanora valesiaca (Müll. Arg.) Stizenb. var. *valesiaca* [2]
Lecanora viridiflava B. de Lesd. [2]
Lecanora weberi B.D. Ryan [2]
Lecanora wetmorei Śliwa [2]
Lecidella anomaloides (A. Massal.) Hertel & H. Kilias [2]
Lecidella asema (Nyl.) Knoph & Hertel [2]

Lecidella carpathica Körb. [2]
Lecidella chiricahuana Knoph & Leuckert [2]
Lecidella effugiens (Nilson) Knoph & Hertel [2]
Lecidella elaeochroma (Ach.) M. Choisy [2]
Lecidella euphorea (Flörke) Hertel [2]
Lecidella granulosula (Nyl.) Knoph & Leuckert [2]
Lecidella latypiza (Nyl.) M. Choisy [2]
Lecidella nashiana Knoph & Leuckert [2]
Lecidella patavina (A. Massal.) Knoph & Leuckert [2]
Lecidella stigmatea (Ach.) Hertel & Leuckert [2]
Lecidella tumidula (A. Massal.) Knoph & Leuckert [2]
Lecidella viridans (Flot.) Körb. [2]
Lecidella wulfenii (Ach.) Körb. [2]
Miriquidica garovaglioi (Schaer.) Hertel & Rambold [2]
Psorinia conglomerata (Ach.) Gotth. Schneid. [1]
Ramboldia elabens (Fr.) Kantvilas & Elix [2]
Rhizoplaca chrysoleuca (Sm.) Zopf [1]
Rhizoplaca melanophthalma (DC.) Leuckert [1]
Rhizoplaca peltata (Ramond) Leuckert & Poelt [1]
Rhizoplaca subdiscrepans (Nyl.) R. Sant. [1]
Strangospora microhaema (Norman) R.A. Anderson [3]
Strangospora moriformis (Ach.) Stein [3]

Parmeliaceae
Ahtiana sphaerosporella (Müll. Arg.) Goward [1]
Arctoparmelia centrifuga (Oxner) Hale [1]
Brodoa oroarctica (Krog) Goward [1]
Bryoria chalybeiformis (L.) Brodo & D. Hawksw. [1]
Bryoria furcellata (Fr.) Brodo & D. Hawksw. [1]
Bryoria fuscescens (Gyeln.) Brodo & D. Hawksw. [1]
Bryoria lanestris (Ach.) Brodo & D. Hawksw. [1]
Bryoria simplicior (Vain.) Brodo & D. Hawksw. [1]
Canoparmelia crozalsiana (B. de Lesd.) Elix & Hale [1]
Canoparmelia texana (Tuck.) Elix & Hale [1]
Cetraria ericetorum subsp. *reticulata* (Räsänen) Kärnefelt [1]
Evernia divaricata (L.) Ach. [1]
Flavoparmelia baltimorensis (Gyeln. & Fóriss) Hale [1]
Flavoparmelia caperata (L.) Hale [1]
Flavopunctelia darrowii (J.W. Thomson) Hale [2]
Flavopunctelia flaventior (Stirt.) Hale [2]
Flavopunctelia praesignis (Nyl.) Hale [2]
Flavopunctelia soredica (Nyl.) Hale [2]
Hypogymnia austerodes (Nyl.) Räsänen [1]
Hypogymnia bitteri (Lynge) Ahti [1]
Hypogymnia farinacea Zopf [1]
Hypogymnia physodes (L.) Nyl. [1]
Hypotrachyna dactylifera (Vain.) Hale [1]
Hypotrachyna laevigata (Sm.) Hale [1]
Hypotrachyna meridensis Hale & López-Fig. [1]
Hypotrachyna pulvinata (Fée) Hale [1]
Hypotrachyna punoensis Kurok. & K.H. Moon [1]
Hypotrachyna pustulifera (Hale) Skorepa [1]
Hypotrachyna revoluta (Flörke) Hale [1]
Hypotrachyna subsaxatilis (B. de Lesd.) Hale [1]
Imshaugia aleurites (Ach.) S.L.F. Mey. [1]
Imshaugia placorodia (Ach.) S.L.F. Mey. [1]
Letharia columbiana (Nutt.) J.W. Thomson [1]
Letharia vulpina (L.) Hue [1]
Melanelia disjuncta (Erichsen) Essl. [1]
Melanelia panniformis (Nyl.) Essl. [1]
Melanelia tominii (Oxner) Essl. [1]
Melanelixia albertana (Ahti) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch [1]*
Melanelixia fuliginosa (Fr. ex Duby) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch [1]*
Melanelixia glabroides (Essl.) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch [1]*
Melanelixia subargentifera (Nyl.) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch [1]*
Melanelixia villosella (Essl.) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch [1]*
Melanohalea elegantula (Zahlbr.) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch [1]*
Melanohalea exasperatula (Nyl.) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch [1]*
Melanohalea subolivacea (Nyl.) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch [1]*
Myelochroa aurulenta (Tuck.) Elix & Hale [1]
Neofuscelia ahtii (Essl.) Essl. [1]
Neofuscelia atticoides (Essl.) Essl. [1]
Neofuscelia brunella (Essl.) Essl. [1]
Neofuscelia chiricahuensis (R.A. Anderson & W.A. Weber) Essl. [1]
Neofuscelia infrapallida (Essl.) Essl. [1]
Neofuscelia occidentalis (Essl.) Essl. [1]
Omphalora arizonica (Tuck. ex Willey) T.H. Nash & Hafellner [1]
Parmelia fraudans (Nyl.) Nyl. [1]
Parmelia glabra (Schaer.) Nyl. [1]
Parmelia saxatilis L. (Ach.) [1]
Parmelia sulcata Taylor [1]
Parmelinopsis horrescens (Taylor) Elix & Hale [1]
Parmelinopsis minarum (Vain.) Elix & Hale [1]
Parmeliopsis ambigua (Wulfen) Nyl. [1]
Parmeliopsis hyperopta (Ach.) Vain. [1]
Parmotrema chinense (Osbeck) Hale & Ahti [1]
Parmotrema crinitum (Ach.) M. Choisy [1]
Parmotrema eurysacum (Hue) Hale [1]
Parmotrema hababianum (Gyeln.) Hale [1]
Parmotrema mordenii (Hale) Hale [1]
Parmotrema stuppeum (Taylor) Hale [1]
Parmotrema subtinctorium (Zahl.) Hale [1]*
Protoparmelia atriseda (Fr.) R. Sant. & V. Wirth [2]
Protoparmelia badia (Hoffm.) Hafellner [2]
Protoparmelia cupreobadia (Nyl.) Poelt [2]
Pseudephebe minuscula (Arnold) Brodo & D. Hawksw. [1]
Pseudevernia intensa (Nyl.) Hale & W.L. Culb. [1]
Punctelia gramìnicola (B. de Lesd.) Egan [2]
Punctelia hypoleucites (Nyl.) Krog [2]
Punctelia perreticulata (Räsänen) G. Wilh. & Ladd [2]
Punctelia rudecta (Ach.) Krog [2]
Punctelia stictica (Delise ex Duby) Krog [2]
Rimelia cetrata (Ach.) Hale & A. Fletcher [1]
Rimelia reticulata (Taylor) Hale & A. Fletcher [1]
Rimelia simulans (Hale) Hale & A. Fletcher [1]
Tuckermanella arizonica Essl. [2]
Tuckermanella coralligera (W.A. Weber) Essl. [2]
Tuckermanella fendleri (Nyl.) Essl. [2]
Tuckermanella weberi (Essl.) Essl. [2]
Usnea amblyoclada (Müll. Arg.) Zahlbr. [3]
Usnea cavernosa Tuck. [3]
Usnea ceratina Ach. [3]
Usnea cirrosa Motyka [3]
Usnea cornuta Körb. subsp. *cornuta* [3]
Usnea diplotypus Vain. [3]
Usnea halei P. Clerc [3]
Usnea hirta (L.) Weber ex F.H. Wigg. subsp. *hirta* [3]
Usnea intermedia Jatta [3]
Usnea lapponica Vain. [3]
Usnea myrmaiacaina P. Clerc [3]
Usnea parvula Motyka [3]
Usnea praetervisa (Asahina) P. Clerc [3]
Usnea scabrata Nyl. [3]
Usnea subfloridana Stirt. [3]
Usnea substerilis Motyka [3]
Vulpicida pinastri (Scop.) J.-E. Mattsson [1]

Xanthoparmelia ahtii (Essl.) O. Blanco, A. Crespo, Elix, D. Hawksw. & Lumbsch [1]*
Xanthoparmelia ajoensis (T.H. Nash) Egan [2]
Xanthoparmelia amableana (Gyeln.) Hale [2]
Xanthoparmelia atticoides (Essl.) O. Blanco, A. Crespo, Elix, D. Hawksw. & Lumbsch [1]
Xanthoparmelia australasica D.J. Galloway [2]
Xanthoparmelia brunella O. Blanco, A. Crespo, Elix, D. Hawksw. & Lumbsch [1]
Xanthoparmelia californica Hale [2]
Xanthoparmelia chlorochroa (Tuck.) Hale [2]
Xanthoparmelia coloradoensis (Gyeln.) Hale [2]
Xanthoparmelia conspersa (Ehrh. ex Ach.) Hale [2]
Xanthoparmelia cumberlandia (Gyeln.) Hale [2]
Xanthoparmelia dierythra (Hale) Hale [2]
Xanthoparmelia digitiformis (Elix & P.M. Armstr.) Filson [2]
Xanthoparmelia dissensa (T.H. Nash) Egan [2]
Xanthoparmelia eganii Elix & T.H. Nash [2]
Xanthoparmelia huachucensis (T.H. Nash) Egan [2]
Xanthoparmelia hypomelaena (Hale) Hale [2]
Xanthoparmelia incerta (Kurok. & Filson) Elix & J. Johnst. [2]
Xanthoparmelia isidiigera (Müll. Arg.) Elix & J. Johnst. [2]
Xanthoparmelia lavicola (Gyeln.) Hale [2]
Xanthoparmelia lineola (E.C. Berry) Hale [2]
Xanthoparmelia lobulatella T.H. Nash & Elix [2]
Xanthoparmelia maricopensis T.H. Nash & Elix [2]
Xanthoparmelia mexicana (Gyeln.) Hale [2]
Xanthoparmelia montanensis Hale [2]
Xanthoparmelia monticola (J.P. Dey) Hale [2]
Xanthoparmelia neocongensis (Hale) Hale [2]
Xanthoparmelia neoconspersa (Gyeln.) Hale [2]
Xanthoparmelia neorimalis (Elix & P.M. Armstr.) Elix & T.H. Nash [2]
Xanthoparmelia neowyomingica Hale [2]
Xanthoparmelia nigrolavicola T.H. Nash & Elix [2]
Xanthoparmelia nigropsoromifera (T.H. Nash) Egan [2]
Xanthoparmelia nigroweberi T.H. Nash & Elix [2]
Xanthoparmelia novomexicana (Gyeln.) Hale [2]
Xanthoparmelia oleosa (Elix & P.M. Armstr.) Elix & T.H. Nash [2]
Xanthoparmelia planilobata (Gyeln.) Hale [2]
Xanthoparmelia plittii (Gyeln.) Hale [2]
Xanthoparmelia pseudocongensis Hale [2]
Xanthoparmelia psoromifera (Hale) Hale [2]
Xanthoparmelia standaertii (Gyeln.) Hale [2]
Xanthoparmelia stenophylla (Ach.) Ahti & D. Hawksw. [2]
Xanthoparmelia subcumberlandia Elix & T.H. Nash [2]
Xanthoparmelia subdecipiens (Vain. ex Lynge) Hale [2]
Xanthoparmelia subplittii Hale [2]
Xanthoparmelia substenophylloides Hale [2]
Xanthoparmelia subtasmanica Elix & T.H. Nash [2]
Xanthoparmelia tasmanica (Hook. f. & Taylor) Hale [2]
Xanthoparmelia tinctina (Maheu & A. Gillet) Hale [2]
Xanthoparmelia tuberculata (Gyeln.) T.H. Nash & Elix [2]
Xanthoparmelia tuckeriana Elix & T.H. Nash [2]
Xanthoparmelia tucsonensis (T.H. Nash) Egan [2]
Xanthoparmelia weberi (Hale) Hale [2]
Xanthoparmelia wyomingica (Gyeln.) Hale [2]

Pilocarpaceae
Micarea denigrata (Fr.) Hedl. [3]
Micarea micrococca (Körb.) Gams ex Coppins [3]
Micarea misella (Nyl.) Hedl. [3]

Psoraceae
Protoblastenia rupestris (Scop.) J. Steiner [2]
Psora cerebriformis W.A. Weber [1]
Psora crenata (Taylor) Reinke [1]
Psora decipiens (Hedw.) Hoffm. [1]
Psora globifera (Ach.) A. Massal. [1]
Psora himalayana (C. Bab.) Timdal [1]
Psora icterica (Mont.) Müll. Arg. [1]
Psora luridella (Tuck.) Fink [1]
Psora nipponica (Zahlbr.) Gotth. Schneid. [1]
Psora pseudorussellii Timdal [1]
Psora russellii (Tuck.) A. Schneid. [1]
Psora tuckermanii R.A. Anderson ex Timdal [1]
Psorula rufonigra (Tuck.) Gotth. Schneid. [1]

Ramalinaceae
Bacidia bagliettoana (A. Massal. & De Not.) Jatta [2]
Bacidia beckhausii Körb. [2]
Bacidia circumspecta (Norrl. & Nyl.) Malme [2]
Bacidia subincompta (Nyl.) Arnold [2]
Bacidia vermifera (Nyl.) Th. Fr. [2]
Bacidina "dissecta" S. Ekman ad int. [2]
Bacidina egenula (Nyl.) Vězda [2]
Biatora chrysantha (Zahlbr.) Printzen [2]
Biatora globulosa (Flörke) Fr. [2]
Biatora meiocarpa (Nyl.) Arnold [2]
Japewia tornoensis (Nyl.) Tønsberg [2]
Mycobilimbia carneoalbida (Müll. Arg.) S. Ekman & Printzen [2]
Mycobilimbia tetramera (De Not.) Vitik., Ahti, Kuusinen, Lommi & T. Ulvinen [2]
Ramalina intermedia Delise ex Nyl. [2]
Ramalina pollinaria (Westr.) Ach. [2]
Ramalina sinensis Jatta [2]

Stereocaulaceae
Hertelidea botryosa (Fr.) Printzen & Kantvilas [2]
Lepraria borealis Loht. & Tønsberg [2]
Lepraria caesioalba (B. de Lesd.) J.R. Laundon [2]
Lepraria elobata Tønsberg [2]
Lepraria lecanorica Tønsberg [2]
Lepraria lobificans Nyl. [2]
Lepraria neglecta (Nyl.) Erichsen [2]
Lepraria nivalis J.R. Laundon [2]
Lepraria rigidula (B. de Lesd.) Tønsberg [2]
Lepraria vouauxii (Hue) R.C. Harris [2]
Squamarina lentigera (Weber) Poelt [1]
Stereocaulon sasakii Zahlbr. [1]

Tephromelataceae
Calvitimela armeniaca (DC.) Hafellner [2]
Tephromela atra (Huds.) Hafellner [2]

Vězdaeaceae
Vězdaea rheocarpa Poelt & Dobbeler [2]

LECIDEALES

Lecideaceae
Lecidea atrobrunnea (Ramond) Schaer. subsp. *atrobrun -nea* [2]
Lecidea atrobrunnea subsp. *saxosa* Hertel & Leuckert [2]
Lecidea atrobrunnea subsp. *stictica* Hertel & Leuckert [2]
Lecidea berengeriana (A. Massal.) Nyl. [2]
Lecidea cruciaria Tuck. [2]
Lecidea diducens Nyl. [2]
Lecidea holopolia (Tuck.) Zahlbr. [2]
Lecidea laboriosa Müll. Arg. [2]
Lecidea leprarioides Tønsberg [2]
Lecidea nylanderi (Anzi) Th. Fr. [2]
Lecidea promiscens Nyl. [2]
Lecidea pseudaglaea Hertel [2]

Lecidea sauteri Körb. [2]
Lecidea tessellata Flörke [2]
Lecidea trapelioides Printzen [2]

Porpidiaceae
Bellemerea alpina (Sommerf.) Clauzade & Cl. Roux [3]
Bellemerea sanguinea (Kremp.) Hafellner & Cl. Roux [3]
Immersaria athroocarpa (Ach.) Rambold & Pietschm. [2]
Porpidia crustulata (Ach.) Hertel & Knoph [2]
Porpidia macrocarpa (DC.) Hertel & A.J. Schwab [2]
Romjularia lurida (Ach.) Timdal [3]

PELTIGERALES

Coccocarpiaceae
Coccocarpia erythroxyli (Spreng.) Swinscow & Krog [1]
Coccocarpia palmicola (Spreng.) Arv. & D.J. Galloway [1]
Spilonema revertens Nyl. [1]

Collemataceae
Collema callopismum A. Massal. [2]
Collema coccophorum Tuck. [2]
Collema conglomeratum Hoffm. [2]
Collema crispum (Huds.) Weber ex F.H. Wigg. [2]
Collema cristatum (L.) Weber ex F.H. Wigg. [2]
Collema flaccidum (Ach.) Ach. [2]
Collema furfuraceum Du Rietz [2]
Collema fuscovirens (With.) J.R. Laundon [2]
Collema occultatum var. *populinum* (Th. Fr.) Degel. [2]
Collema polycarpon Hoffm. [2]
Collema subflaccidum Degel. [2]
Collema subnigrescens Degel. [2]
Collema subparvum Degel. [2]
Collema tenax (Sw.) Ach. [2]
Collema texanum Tuck. [2]
Collema undulatum var. *granulosum* Degel. [2]
Leptogium arsenei Sierk [2]
Leptogium austroamericanum (Malme) C.W. Dodge [2]
Leptogium burgessii (L.) Mont. [2]
Leptogium burnetii C.W. Dodge [2]
Leptogium californicum Tuck. [2]
Leptogium chloromelum (Aeh.) Nyl. [2]
Leptogium coralloideum (Meyen & Flot.) Vain. [2]
Leptogium cyanescens (Pers.) Körb. [2]
Leptogium "denticulatum" Nyl. Sensu Sierk [2]
Leptogium digitatum (A. Massal.) Zahlbr. [2]
Leptogium gelatinosum (With.) J.R. Laundon [2]
Leptogium hypotrachynum Müll. Arg. [2]
Leptogium juniperinum Tuck. [2]
Leptogium laceroides B. de Lesd. [2]
Leptogium lichenoides (L.) Zahlbr. [2]
Leptogium milligranum Sierk [2]
Leptogium papillosum (B. de Lesd.) C.W. Dodge [2]
Leptogium phyllocarpum (Pers.) Mont. [2]
Leptogium plicatile (Ach.) Leight. [2]
Leptogium pseudofurfuraceum P.M. Jørg. & A.K. Wallace [2]
Leptogium resupinans Nyl. [2]
Leptogium rugosum Sierk [2]
Leptogium saturninum (Dicks.) Nyl. [2]
Leptogium subaridum P.M. Jørg. & Goward [2]
Leptogium subtile (Schrad.) Torss. [2]
Leptogium tenuissimum (Hoffm.) Körb. [2]

Lobariaceae
Sticta beauvoisii Delise [2]
Sticta fuliginosa (Dicks.) Ach. [2]
Sticta leucoblephara (Müll. Arg.) D.J. Galloway [2]
Sticta sylvatica (Huds.) Ach. [2]
Sticta xanthotropa (Kremp.) D.J. Galloway [2]

Massalongiaceae
Leptochidium albociliatum (Desm.) M. Choisy [1]
Massalongia carnosa (Dicks.) Körb. [1]

Nephromataceae
Nephroma bellum (Spreng.) Tuck. [1]
Nephroma helveticum Ach. [1]
Nephroma parile (Ach.) Ach. [1]
Nephroma resupinatum (L.) Ach. [1]

Pannariaceae
Fuscopannaria mediterranea (Tav.) P.M. Jørg. [1]
Fuscopannaria praetermissa (Nyl.) P.M. Jørg. [1]
Pannaria conoplea (Pers.) Bory [1]
Pannaria subfusca P.M. Jørg. [1]
Pannaria tavaresii P.M. Jørg. [1]
Parmeliella triptophylla (Ach.) Müll. Arg. [1]
Protopannaria pezizoides (Weber ex F.H. Wigg.) P.M. Jørg. & S. Ekman [1]
Psoroma hypnorum (Vahl) Gray. [1]
Psoroma tenue var. *boreale* Henssen [1]

Peltigeraceae
Peltigera collina (Ach.) Röhl. [2]
Peltigera didactyla (With.) J.R. Laundon [2]
Peltigera elisabethae Gyeln. [2]
Peltigera extenuata (Nyl.) Vain. [2]
Peltigera fibrilloides (Gyeln.) Vitik. [2]
Peltigera horizontalis (Huds.) Baumg. [2]
Peltigera lepidophora (Nyl.) Bitter [2]
Peltigera leucophlebia (Nyl.) Gyeln. [2]
Peltigera malacea (Ach.) Funck [2]
Peltigera membranacea (Ach.) Nyl. [2]
Peltigera monticola Vitik. [2]
Peltigera neckeri Hepp ex Müll. Arg. [2]
Peltigera neopolydactyla (Gyeln.) Gyeln. [2]
Peltigera polydactylon (Neck.) Hoffm. [2]
Peltigera ponojensis Gyeln. [2]
Peltigera praetextata (Flörke ex Sommerf.) Vain. [2]
Peltigera rufescens (Weiss) Humb. [2]
Peltigera venosa (L.) Hoffm. [2]
Solorina spongiosa (Huds.) Anzi [2]

Placynthiaceae
Koerberia biformis A. Massal. [1]
Koerberia sonomensis (Tuck.) Henssen [1]
Placynthium asperellum (Ach.) Trevis. [1]
Placynthium nigrum (Huds.) Gray [1]
Placynthium stenophyllum var.*isidiatum* Henssen [1]
Placynthium subradiatum (Nyl.) Arnold [1]

RHIZOCARPALES

Catillariaceae
Catillaria chalybeia (Borrer) A. Massal. [3]
Catillaria glauconigrans (Tuck.) Hasse [3]
Catillaria lenticularis (Ach.) Th. Fr. [3]
Catillaria nigroclavata (Nyl.) Schuler [3]
Halecania australis Lumbsch [2]
Sporastatia testudinea (Ach.) A. Massal. [2]
Toninia candida (Weber) Th. Fr. [1]
Toninia cinereovirens (Schaer.) A. Massal. [1]
Toninia lutosa (Ach.) Timdal [1]
Toninia massata (Tuck.) Herre [1]
Toninia philippea (Mont.) Timdal [1]
Toninia ruginosa (Tuck.) Herre subsp. *ruginosa* [1]
Toninia sculpturata (H. Magn.) Timdal [1]

Toninia sedifolia (Scop.) Timdal [1]
Toninia squalida (Ach.) A. Massal. [1]
Toninia subdiffracta Timdal [1]
Toninia submexicana B. de Lesd. [1]
Toninia tristis subsp. *arizonica* Timdal [1]
Toninia tristis subsp. *asiae-centralis* (H. Magn.) Timdal [1]
Toninia tristis (Th. Fr.) Th. Fr. subsp. *tristis* [1]
Toninia weberi Timdal [1]

Rhizocarpaceae
Rhizocarpon arctogenum Gelting [2]
Rhizocarpon badioatrum (Flörke ex Spreng.) Th. Fr. [2]
Rhizocarpon dimelaenae Timdal [2]
Rhizocarpon disporum (Nägeli ex Hepp) Müll. Arg. [2]
Rhizocarpon distinctum Th. Fr. [2]
Rhizocarpon effiguratum (Anzi) Th. Fr. [2]
Rhizocarpon eupetraeum (Nyl.) Arnold [2]
Rhizocarpon geminatum Körb. [2]
Rhizocarpon geographicum (L.) DC. [2]
Rhizocarpon grande (Flörke ex Flot.) Arnold [2]
Rhizocarpon macrosporum Räsänen [2]
Rhizocarpon cf. *obscuratum* (Ach.) A. Massal. [2]
Rhizocarpon polycarpum (Hepp) Th. Fr. [2]
Rhizocarpon riparium Räsänen [2]
Rhizocarpon simillimum (Anzi) Lettau [2]
Rhizocarpon superficiale (Schaer.) Malme [2]
Rhizocarpon viridiatrum (Wulfen) Körb. [2]

TELOSCHISTALES

Caliciaceae
Amandinea dakotensis (H. Magn.) P.F. May & Sheard [3]*
Amandinea polyspora (Willey) E. Lay & P.F. May [3]*
Amandinea punctata (Hoffm.) Coppins & Scheid. [3]*
Buellia aethalea (Ach.) Th. Fr. [3]
Buellia badia (Fr.) A. Massal. [3]
Buellia cedricola Werner [3]
Buellia disciformis (Fr.) Mudd [3]
Buellia dispersa A. Massal. [3]
Buellia eganii Bungartz [3]
Buellia erubescens Arnold [3]
Buellia lacteoidea B. de Lesd. [3]
Buellia mamillana (Tuck.) W.A. Weber [3]
Buellia mexicana J. Steiner [3]
Buellia nashii Bungartz [3]
Buellia navajoensis Bungartz [3]
Buellia pullata Tuck. [3]
Buellia sequax (Nyl.) Zahlbr. [3]
Buellia spuria (Schaer.) Anzi [3]
Buellia subaethalea B. de Lesd. [3]
Buellia subdispersa Mig. [3]
Buellia tesserata Körb. [3]
Buellia triseptata A. Nordin [3]
Buellia tyrolensis Körb. [3]
Buellia uberior Anzi [3]
Buellia vilis Th. Fr. [3]
Calicium abietinum Pers. [2]
Calicium corynellum (Ach.) Ach. [2]
Calicium montanum Tibell [2]
Calicium salicinum Pers. [2]
Calicium trabinellum (Ach.) Ach. [2]
Calicium viride Pers. [2]
Cyphelium lucidum (Th. Fr.) Th. Fr. [2]
Cyphelium tigillare (Ach.) Ach. [2]
Dimelaena oreina (Ach.) Norman [2]
Dimelaena thysanota (Tuck.) Hale & W.L. Culb. [2]
Diplotomma alboatrum (Hoffm.) Flot. [3]*
Diplotomma venustum (Körb.) Körb. [3]*
Dirinaria neotropica Kalb [2]
Gassicurtia coccinea Fée [3]*
Pyxine cocoes (Sw.) Nyl. [1]
Pyxine petricola Nyl. [1]
Pyxine sorediata (Ach.) Mont. [1]
Pyxine subcinerea Stirt. [1]
Tetramelas chloroleucus (Körb.) A. Nordin [3]*
Tetramelas triphragmioides (Anzi) A. Nordin & Tibell [3]*

Physciaceae
Anaptychia elbursiana (Szatala) Poelt [1]
Culbersonia nubila (Moberg) Essl. [1]
Heterodermia albicans (Pers.) Swinscow & Krog [1]
Heterodermia appalachensis (Kurok.) W.L. Culb. [1]
Heterodermia granulifera (Ach.) W.L. Culb. [1]
Heterodermia hypoleuca (Mühl.) Trevis. [1]
Heterodermia japonica (M. Satô) Swinscow & Krog [1]
Heterodermia leucomela (L.) Poelt [1]
Heterodermia obscurata (Nyl.) Trevis. [1]
Heterodermia podocarpa (Bél.) D.D. Awasthi [1]
Heterodermia pseudospeciosa (Kurok.) W.L. Culb. [1]
Heterodermia rugulosa (Kurok.) Trass [1]
Heterodermia speciosa (Wulfen) Trevis. [1]
Heterodermia tropica (Kurok.) Kurok. [1]
Hyperphyscia adglutinata (Flörke) H. Mayrhofer & Poelt [1]
Phaeophyscia adiastola (Essl.) Essl. [2]
Phaeophyscia ciliata (Hoffm.) Moberg [2]
Phaeophyscia decolor (Kashiw.) Essl. [2]
Phaeophyscia endococcinoides (Poelt) Essl. [2]
Phaeophyscia hirsuta (Mereschk.) Moberg [2]
Phaeophyscia hispidula (Ach.) Moberg [2]
Phaeophyscia insignis (Mereschk.) Moberg [2]
Phaeophyscia kairamoi (Vain.) Moberg [2]
Phaeophyscia nigricans (Flörke) Moberg [2]
Phaeophyscia orbicularis (Neck.) Moberg [2]
Phaeophyscia pusilloides (Zahlbr.) Essl. [2]
Phaeophyscia sciastra (Ach.) Moberg [2]
Physcia adscendens (Th. Fr.) H. Olivier [1]
Physcia aipolia (Ehrh. ex Humb.) Fürnr. [1]
Physcia biziana (A. Massal.) Zahlbr. [1]
Physcia caesia (Hoffm.) Hampe ex Fürnr. [1]
Physcia convexa Müll. Arg. [1]
Physcia dimidiata (Arnold) Nyl. [1]
Physcia dubia (Hoffm.) Lettau [1]
Physcia erumpens Moberg [1]
Physcia halei J.W. Thomson [1]
Physcia nashii Moberg [1]
Physcia phaea (Tuck.) J.W. Thomson [1]
Physcia poncinsii Hue [1]
Physcia sinuosa Moberg [1]
Physcia stellaris (L.) Nyl. [1]
Physcia tribacia (Ach.) Nyl. [1]
Physcia undulata Moberg [1]
Physciella chloantha (Ach.) Essl. [2]
Physciella melanchra (Hue) Essl. [2]
Physciella nepalensis (Poelt) Essl. [2]
Physconia detersa (Nyl.) Poelt [1]
Physconia elegantula Essl. [1]
Physconia enteroxantha (Nyl.) Poelt [1]
Physconia isidiomuscigena Essl. [1]
Physconia leucoleiptes (Tuck.) Essl. [1]
Physconia muscigena (Ach.) Poelt [1]
Physconia perisidiosa (Erichsen) Moberg [1]
Rinodina archaea (Ach.) Arnold [2]
Rinodina athallina H. Magn [2]
Rinodina aurantiaca Sheard [2]
Rinodina bischoffii (Hepp) A. Massal. [2]
Rinodina boulderensis Sheard [2]
Rinodina capensis Hampe [2]
Rinodina castanomela (Nyl.) Arnold [2]

Rinodina coloradiana H. Magn. [2]
Rinodina confragosa (Ach.) Körb. [2]
Rinodina efflorescens Malme [3]
Rinodina glauca Ropin [2]
Rinodina grandilocularis Sheard [2]
Rinodina guzzinii Jatta [2]
Rinodina herrei H. Magn. [2]
Rinodina intermedia Bagl. [2]
Rinodina juniperina Sheard [2]
Rinodina metaboliza Vain. [2]
Rinodina milvina (Wahlenb.) Th. Fr. [2]
Rinodina mniaraea (Ach.) Körb. [2]
Rinodina oxydata (A. Massal.) A. Massal. [2]
Rinodina parasitica H. Mayrhofer & Poelt [2]
Rinodina perreagens Sheard [2]
Rinodina trevisanii (Hepp) Körb. [2]
Rinodina verruciformis Sheard [2]
Rinodina zwackhiana (Kremp.) Körb. [2]

Teloschistaceae
Caloplaca albovariegata (B. de Lesd.) Wetmore [3]
Caloplaca ammiospila (Wahlenb.) H. Olivier [3]
Caloplaca arenaria (Pers.) Müll. Arg. [3]
Caloplaca arizonica H. Magn. [3]
Caloplaca atroalba (Tuck.) Zahlbr. [3]
Caloplaca atroflava (Turner) Mong. [3]
Caloplaca brouardii (B. de Lesd.) Zahlbr. [3]
Caloplaca cerina (Ehrh. ex Hedw.) Th. Fr. [3]
Caloplaca chlorina (Flot.) H. Olivier [3]
Caloplaca chrysodeta (Vain. ex Räsänen) Dombr. [3]
Caloplaca cinnabarina (Ach.) Zahlbr. [3]
Caloplaca citrina (Hoffm.) Th. Fr. [3]
Caloplaca cladodes (Tuck.) Zahlbr. [3]
Caloplaca conversa (Kremp.) Jatta [3]
Caloplaca crenulatella (Nyl.) H. Olivier [3]
Caloplaca dakotensis Wetmore [3]
Caloplaca decipiens (Arnold) Blomb. & Forssell [3]
Caloplaca demissa (Körb.) Arup & Grube [3]
Caloplaca durietzii H. Magn. [3]
Caloplaca epithallina Lynge [3]
Caloplaca ferruginea (Huds.) Th. Fr. [3]
Caloplaca flavovirescens (Wulfen) Dalla Torre & Sarnth. [3]
Caloplaca furfuracea H. Magn. [3]
Caloplaca grimmiae (Nyl.) H. Olivier [3]
Caloplaca holocarpa (Hoffm.) A.E. Wade [3]
Caloplaca microthallina Wedd. [3]
Caloplaca parviloba Wetmore [3]
Caloplaca pellodella (Nyl.) Hasse [3]
Caloplaca persimilis Wetmore [3]
Caloplaca phyllidizans Wetmore [3]
Caloplaca pinicola H. Magn. [3]
Caloplaca saxicola (Hoffm.) Nordin [3]
Caloplaca schoeferi Poelt [3]
Caloplaca sideritis (Tuck.) Zahlbr. [3]
Caloplaca sinapisperma (Lam. & DC.) Maheu & A. Gillet [3]
Caloplaca sonorae Wetmore [3]
Caloplaca squamosa (B. de Lesd.) Zahlbr. [3]
Caloplaca stellata Wetmore & Kärnefelt [3]
Caloplaca subsoluta (Nyl.) Zahlbr. [3]
Caloplaca tetraspora (Nyl.) H. Olivier [3]
Caloplaca tiroliensis Zahlbr. [3]
Caloplaca tominii Savicz [3]
Caloplaca trachyphylla (Tuck.) Zahlbr. [3]
Caloplaca variabilis (Pers.) Müll. Arg. [3]
Caloplaca wetmorei Nimis, Poelt & Tretiach [3]
Fulgensia desertorum (Tomin) Poelt [2]
Fulgensia subbracteata (Nyl.) Poelt [2]
Seirophora contortuplicata (Ach.) Frödén [2]*
Xanthomendoza fallax (Hepp) Søchting, Kärnefelt & S.Y. Kondr. [2]
Xanthomendoza montana (L. Lindblom) Sochting, Kärnefelt & S.Y. Kondr. [2]
Xanthomendoza ulophyllodes (Räsänen) Søchting, Kärnefelt & S.Y. Kondr. [2]
Xanthoria candelaria (L.) Th. Fr. [2]
Xanthoria elegans (Link) Th. Fr. [2]
Xanthoria sorediata (Vain.) Poelt [2]

OSTROPOMYCETIDAE
AGYRIALES

Agyriaceae
Lignoscripta atroalba B.D. Ryan & T.H. Nash [2]
Trapeliopsis flexuosa (Fr.) Coppins & P. James [2]
Trapeliopsis granulosa (Hoffm.) Lumbsch [2]
Xylographa crassithallia B.D. Ryan & T.H. Nash [2]
Xylographa parallela (Ach.) Fr. [2]
Xylographa pruinodisca B.D. Ryan & T.H. Nash [2]
Xylographa vitiligo (Ach.) J.R. Laundon [2]

Schaereriaceae
Schaereria dolodes (Nyl.) Schmull & T. Sprib. [3]
Schaereria fuscocinerea (Nyl.) Clauzade & Cl. Roux [2]

Trapeliaceae
Placynthiella icmalea (Ach.) Coppins & P. James [2]
Placynthiella oligotropha (J.R. Laundon) Coppins & P. James [2]
Placynthiella uliginosa (Schrad.) Coppins & P. James [2]
Rimularia insularis (Nyl.) Rambold & Hertel [2]
Trapelia coarctata (Turner ex Sm.) M. Choisy [2]
Trapelia glebulosa (Sm.) J.R. Laundon [2]*

BAEOMYCETALES

Baeomycetaceae
Baeomyces rufus (Huds.) Rebent. [1]

OSTROPALES

Gyalectaceae
Gyalecta foveolaris (Ach.) Schaer. [2]

Stictidaceae
Absconditella lignicola Vězda & Pišút [2]

Thelotrematacea
Diploschistes actinostomus (Ach.) Zahlbr. [1]
Diploschistes aeneus (Müll. Arg.) Lumbsch [1]
Diploschistes arabiensis Lumbsch [1]
Diploschistes badius Lumbsch & Elix [1]
Diploschistes caesioplumbeus (Nyl.) Vain. [1]
Diploschistes diacapsis (Ach.) Lumbsch [1]
Diploschistes muscorum (Scop.) R. Sant. [1]
Diploschistes scruposus (Schreb.) Norman [1]

PERTUSARIALES

Megasporaceae
Aspicilia americana B. de Lesd. [3]
Aspicilia aquatica Körb. [3]
Aspicilia arizonica Owe-Larss. & A. Nordin [3]
Aspicilia boykinii Owe-Larss. & A. Nordin [3]
Aspicilia cinerea (L.) Körb. [3]
Aspicilia contorta (Hoffm.) Kremp. [3]
Aspicilia desertorum (Kremp.) Mereschk. [3]
Aspicilia determinata (H. Magn.) J.C. Wei [3]

Aspicilia hispida Mereschk. [3]
Aspicilia olivaceobrunnea Owe-Larss. & A. Nordin [3]
Aspicilia substictica Owe-Larss. & A. Nordin [3]
Lobothallia alphoplaca (Wahlenb.) Hafellner [2]
Lobothallia praeradiosa (Nyl.) Hafellner [2]
Lobothallia radiosa (Hoffm.) Hafellner [2]
Megaspora verrucosa var. *mutabilis* (Ach.) Nimis & Cl. Roux [3]
Megaspora verrucosa (Ach.) Hafellner & V. Wirth var. *verrucosa* [3]

Ochrolechiaceae
Ochrolechia africana Vain. [2]
Ochrolechia androgyna (Hoffm.) Arnold [2]
Ochrolechia mexicana Vain. [2]
Ochrolechia pseudopallescens Brodo [2]
Ochrolechia splendens Lumbsch & Messuti [2]
Ochrolechia subisidiata Brodo [2]
Ochrolechia subpallescens Verseghy [2]

Pertusariaceae
Pertusaria amara (Ach.) Nyl. [1]
Pertusaria azulensis B. de Lesd. [1]
Pertusaria flavicunda Tuck. [1]
Pertusaria hymenea (Ach.) Schaer. [1]
Pertusaria mariae B. de Lesd. [1]
Pertusaria moreliensis B. de Lesd. [1]
Pertusaria ophthalmiza (Nyl.) Nyl. [1]
Pertusaria saximontana Wetmore [1]
Pertusaria sommerfeltii (Sommerf.) Fr. [1]
Pertusaria stenhammarii Hellb. [1]
Pertusaria tejocotensis B. de Lesd. [1]
Pertusaria wulfenioides B. de Lesd. [1]

† LICHINOMYCETES
LICHINOMYCETIDAE
LICHINALES

Gloeoheppiaceae
Gloeoheppia polyspora Henssen [1]
Gloeoheppia squamulosa (Zahlbr.) M. Schultz [3]

Lichinaceae
Anema progidulum (Nyl.) Henssen [1]
Ephebe ocellata Henssen [2]
Ephebe perspinulosa Nyl. [2]
Heppia adglutinata (Kremp.) A. Massal. [1]
Heppia conchiloba Zahlbr. [1]
Heppia despreauxii (Mont.) Tuck. [1]
Heppia lutosa (Ach.) Nyl. [1]
Lemmopsis arnoldiana (Hepp) Zahlbr. [1]
Lempholemma chalazanum (Ach.) B. de Lesd. [2]
Lempholemma cladodes (Tuck.) Zahlbr. [2]
Lempholemma polyanthes (Bernh.) Malme [2]
Lichinella americana Henssen [3]
Lichinella cribellifera (Nyl.) P.P. Moreno & Egea [3]
Lichinella flexa Henssen, Büdel & T.H. Nash [3]
Lichinella granulosa M. Schultz [3]
Lichinella intermedia Henssen, Büdel & T.H. Nash [3]
Lichinella iodopulchra (Couderc ex Croz.) P.P. Moreno & Egea [3]
Lichinella minnesotensis (Fink) Essl. [3]
Lichinella myriospora (Zahlbr.) P.P.Moreno & Egea ex Schultz [3]
Lichinella nigritella (Lettau) P.P. Moreno & Egea [3]
Lichinella sinaica (Galun & Marton) P.P. Moreno & Egea [3]
Lichinella stipatula Nyl. [3]
Metamelanea melanobola (Tuck.) Henssen [2]
Peccania arizonica Tuck. ex Herre [3]
Peccania subnigra (B. de Lesd.) Wetmore [3]
Peccania tiruncula (Nyl.) Henssen [3]
Phloeopeccania pulvinulina J. Steiner [3]
Porocyphus coccodes (Flot.) Körb. [1]
Psorotichia hassei Fink ex J. Hedrick [3]
Psorotichia montinii (A. Massal.) Forssell [3]
Psorotichia murorum A. Massal. [3]
Psorotichia schaereri (A. Massal.) Arnold [3]
Psorotichia taurica (Nyl.) Vain. [3]
Pterygiopsis cava M. Schultz [3]
Stromatella bermudana (Riddle) Henssen [1]
Synalissa mattogrossensis (Malme) Henssen [1]
Thyrea confusa Henssen [1]

Peltulaceae
Peltula bolanderi (Tuck.) Wetmore [1]
Peltula clavata (Kremp.) Wetmore [1]
Peltula euploca (Ach.) Poelt ex Ozenda & Clauzade [1]
Peltula farinosa Büdel [1]
Peltula michoacanensis (B. de Lesd.) Wetmore [1]
Peltula obscurans var. *deserticola* (Zahlbr.) Wetmore [1]
Peltula obscurans var. *hassei* (Zahlbr.) Wetmore [1]
Peltula obscurans (Nyl.) Gyeln. var. *obscurans* [1]
Peltula omphaliza (Nyl.) Wetmore [1]
Peltula patellata (Bagl.) Swinscow & Krog [1]
Peltula placodizans (Zahlbr.) Wetmore [1]
Peltula psammophila (Nyl.) Egea [1]
Peltula richardsii (Herre) Wetmore [1]
Peltula tortuosa (Nees) Wetmore [1]
Peltula zahlbruckneri (Hasse) Wetmore [1]

Annotation Key. Annotations [in brackets] follow each taxon, and those with an asterisk '*' have been updated according to the *North American Lichen Checklist* of Esslinger 2010. Each record cites the source with a number (see *Literature Cited*):

1 – Nash, Ryan, Gries, and Bungartz 2002; **2** – Nash, Ryan, Diederich, Gries, and Bungartz 2004; **3** – Nash, Gries, and Bungartz 2007; **4** – Westberg and Arup 2010

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Review of Field Guide to Forest and Mountain Plants of Northern Arizona
By Judith D. Springer, Mark L. Daniels, and Mare Nazaire
With forward by Bruce Babbitt

Editors of collaborative floras face a number of time-consuming challenges and our Arizona floras are shamefully dated as a result: In 1973 W. B. McDougal's *Seed Plants of Northern Arizona; with keys and detailed descriptions for the identification of families, genera, and species,* was published; and the Second Edition of Kearney and Peebles' *Arizona Flora* came out in 1960, so the need for modern treatments is acute. *Field Guide to Forest & Mountain Plants of Northern Arizona* is a welcome newcomer to the canon of regional floras of Arizona and the Southwest. Springer, Daniels, and Nazaire's *Field Guide* does not replace McDougal or K & P as a comprehensive flora, so there is some truth to the publisher's promo "First of its kind for the forested and higher elevation ecosystems of northern and eastern Arizona" since the authors attempt to "walk the line between field guide and flora." As a hybrid, this book is much more geared toward the professional botanist rather than informed lay audience, but does a fair job of appealing to both. As a botanical resource it works just fine. The layout is friendly and utilitarian. Plants are organized by recognizable form (the "field guide" character of the book) – "Conifers," "Flowering Trees and Shrubs," "Grasses, Sedges, and Rushes," "Wildflowers," "Cacti and Agaves," and "Aquatics." Of course, any artificial separation by form has its problems, and where things are filed is sometimes arbitrary. For example, partially woody species as *Argythamnia cyanophylla*, *Artemisia dracunculus*, *Brickellia brachyphylla*, *Galium microphyllum*, etc. are among the "Wildflowers" rather than "Flowering Trees and Shrubs", and *Ranunculus aquaticus* is found in the "Wildflowers" section rather than "Aquatics." In each category, species are alphabetized by family following a technical description. Species descriptions are detailed and thorough (the "flora" character of the book). With some variation among groups, most contain the headings "General," "Leaves," "Flowers," "Fruits," "Habitat/Range," "Notes," and often synonymy. The species descriptions are also loaded with botanical terminology specific to the group. Users who aren't familiar with a composite phyllary, a grass spikelet, or a fern sorus, will be glad there is a glossary. Dichotomous keys are also naturally technical but the jargon is necessary for a guide to be functional. The etymology appendix is a wonderful touch, I wish more authors would include this – definitions of Latinized and Greek words and/or explanations of the Latinized proper names. For example, "**bebbiana** – for Michael Schuck Bebb (1833-1895), American willow specialist;" or "**thelypodium** – for the Greek "thele" (female) and "podo" (foot)."

The "Notes" section typically contains the most text, and spans a variety of topics such as, ecology: "*Glycyrrhiza lepidota* aggressively colonizes disturbed riparian areas. It has good soil-stabilizing capabilities and may be used in restoration planting and for erosion control;" taxonomy: "Taxonomic confusion exists with regard to southern populations of *Abies bifolia.* Authorities in the southwestern U.S. treat the species as *A. lasiocarpa* var. *arizonica.* The Flora of North America (1993) suggests that the species should be a segregate of *A. bifolia*, but recognizes that the southern populations in its distribution have unique

characteristics. To date, the taxonomy is unresolved;" ethnobotany: "A poultice of the plant (*Descurainia sophia*) may be applied for toothaches, and the Paiute use a poultice of ground seeds to remedy burns and sores;" Relevant characters to distinguish similar taxa: "*Erigeron oreophilus* is very similar to *E. neomexicanus,* but the former may be distinguished by stalked glands on the stems, leaves, and phyllaries;" horticultural tidbits: "*Penstemon palmeri* is widely available as an ornamental and easily propagated by seed;" and important synonyms. The information in the "Notes" is anecdotal and lacking any references e.g., "pinyon pine is slow growing but long lived, easily surviving up to 500 or more years," but interesting and thorough.

The book is extensively illustrated. I loved the 288 color glossy inserts in the middle – not a dud in the lot. Some photo credits are a bit head-scratching though, for example, Kristin Huisinga is credited for *Asclepias subverticillata*, Max Licher for *A. speciosa*, and *A. tuberosa*, but the photo in the book is Mark Daniels' *Asclepias asperula.* Nevertheless, Licher and Daniels took much care with focus, composition, and color; and flower details are clear and informative, even in the tiniest species. The line drawings of species are for the most part well done and true to the plant, but there are shortcomings. The art is inconsistent in style, weight and detail, a result of being harvested by a number of different sources. There are no scale bars, there are a few nearly useless 'stick drawings' with very little information (e.g. *Drymaria* spp., several *Carex* spp.), and many are very old (grass nerds will recognize several Agnes Chase drawings from the 1950 Hitchcock Manual).

On the back cover of this book the publishers claim, "...comprehensive species coverage for the region with an easy-to-use format..." and Tom Whitham, a Regent's Professor at Northern Arizona University calls the book "A comprehensive and welcome field guide for the high elevation country plants of northern Arizona..." Even the author's claim in the Introduction, "This book is the work of numerous collaborators, who came together to create a comprehensive, up-to-date botanical resource for the northern Arizona forests in which we work and play." Similarly, four paragraphs later: "As written, the guide includes comprehensive coverage of species found in the high-elevation forests of the Mogollon Rim and White Mountains, the San Francisco Peaks, and associated mountains near Flagstaff, the Coconino Plateau near the south rim of the Grand Canyon, the Uinkaret Mountains and the Kaibab Plateau to the north of the Grand Canyon, the mountains of the Navajo Reservation in the northeastern corner of the state, and several small high-elevation 'islands' within the overall range." There are roughly 1400 taxa distinguished (including those that are only mentioned in the keys) and 785 taxa are treated with species descriptions and illustrations. This is where the book fails to live up to the publicity claims of comprehensiveness. A flora of the above mentioned areas would have many more taxa. In fact, this treatment does not achieve "comprehensive" species coverage of even one of the individual ranges mentioned. Are there only six orchids for the entire region? "Higher elevation forests" is never specifically defined, but in the White Mountain alone, we would expect to see *Corallorrhiza striata, Epipactis gigantea, Goodyera decipiens, G. repens, Malaxis ehrenbergia, M. macrostachya, Platanthera hyperborea, P. sparsiflora, and P. stricta;* none of which are included in any key or description. There are other

curious omissions. *Helianthus annuus* is the lone sunflower and there must be at least four others that occur within the flora region (*H. arizonensis, H. ciliaris, H. nuttallii, H. petiolaris*). The needlegrasses and gramas are also underrepresented. *Achnatherum hymenoides, A. nelsonii,* and *Hesperostipa comata* are treated, but *A. aridum, A. lettermannii, A. robustum, A. scribneri, A. thurberianum,* and possibly *H. neomexicana*, are all members of higher elevations of northern and eastern Arizona. *Bouteloua eriopoda*, *B. hirsuta,* and *B. simplex* are also common in the flora region, even *B. barbata* is likely to occur as a weedy annual, but only *B. curtipendula* and *B. gracilis* are listed. There are other problems: only four species of *Cyperus*, one species of *Physalis* are included. Some of the woody plants that stood out as missing were *Frangula californica, Garrya wrightii, Lycium andersonii, Platanus wrightii*, *Quercus chrysolepis,* and *Q. grisea.* Other larger genera are incomplete. For example, there are 19 *Astragalus* in the *Field Guide* key, and 8 are described and illustrated. A checklist of *Astragalus* generated from a SEINet search [http:// swbiodiversity.org/seinet/index.php] in Coconino County alone brings up 134 taxa. While this is an over estimate because it includes subspecific taxa and collections from lower elevation areas such as the Grand Canyon, there are certainly more than the 19 distinguished. Perhaps a better format would have been to make it clear that all species are not included in the illustrations and descriptions, but species known to occur in this flora region are at least inlcuded in the keys. The point is, of course, you may have a plant in hand that is not in the book, especially if it is from a large genus such as *Brickellia*, *Bromus*, *Carex*, *Euphorbia*, *Packera*, etc.

The forward by Bruce Babbitt gives it instant credibility. However, he doesn't make much commentary on the book, but instead waxes historical about two early researchers in the area – C. Hart Merriam and Aldo Leopold. From these two giants, he jumps to recognizing recent research efforts at Northern Arizona University and thanking the authors for their contribution to the body of knowledge of the forest ecosystems. I commend the contribution as well, and appreciate the efforts of the authors. My criticism is with the omissions and ambiguities, not with the content. These collaborators put together a nice work of hundreds of plants known to occur "from the Mogollon Rim and White Mountains north," and it is quite acceptable without the lofty claims. People in the botanical trenches around the world are begging for more keys, more manuals, more floras, more descriptions, more monographs; and though limited as a flora because of the lack of comprehensiveness, the target audience will not be disappointed by this positive attempt at a useful botanical resource.

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